National Information Exchange Model
Concept of Operations

NIEM Program Management Office

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1. INTRODUCTION AND OVERVIEW OF NIEM

1.1. What is NIEM?

The National Information Exchange Model (NIEM) is a partnership of the U.S. Department of Justice (DOJ) and U.S. Department of Homeland Security (DHS). It is designed to develop, disseminate, and support enterprise-wide Information Exchange Package Documentation (IEPD) and processes that will enable jurisdictions and agencies throughout the nation to effectively share critical information in both emergency and routine situations.

NIEM focuses on discrete information exchanges between agency information systems. NIEM will provide the information sharing structure necessary for first responders and decision makers to have the right information to prepare for, prevent, and respond to major terrorist events and natural disasters. Also, it will enhance the day-to-day capabilities of practitioners at all levels of government in making crucial decisions about border enforcement, passenger screening, port security, intelligence analysis, local law enforcement and judicial processing, correctional supervision and release, and a variety of other governmental functions.

The vision for NIEM is to be the standard, by choice, for intergovernmental information exchange.

The primary NIEM objectives are to:

- Bring stakeholders together to identify information sharing requirements for operational and emergency situations.
- Maintain a national model containing universal, common, and domain-specific data components that pertain to agency information needs in order to facilitate development of an IEPD.
- Develop standards, a common vocabulary, and an online repository of IEPDs to support information sharing.
- Provide technical tools to support development, discovery, dissemination, and reuse of IEPDs.
- Provide training, technical assistance, and implementation support services, as appropriate.

Developing and implementing NIEM exchange standards means that the major investments local, state, tribal, and federal governments have made in existing information systems can be leveraged and that these governments can efficiently participate in a truly national information sharing environment. NIEM standards enable different information systems to share and exchange information, irrespective of the particular technologies at use. Moreover, creating and adopting NIEM standards means that local, state, tribal, and federal organizations avoid the problem of rebuilding or significantly altering their systems to share information.

NIEM is not a software program or a computer system nor does it contain specific information regarding people, events, and incidents. NIEM is designed to facilitate information exchange between different domains, such as justice, public safety, emergency and disaster management, intelligence, and homeland security. NIEM makes this possible by providing the data standards and exchange methods for defining these cross-domain exchanges. As NIEM grows, the Web site will serve as a repository for tools and it will facilitate collaboration for technical personnel across the country. NIEM will be built on a practitioner-driven model, yet it

will remain under the control of DOJ and DHS in terms of content, quality, and expansion of scope to other domains like Health and Transportation.

1.2. Background

DOJ and DHS launched NIEM on February 28, 2005.[1] It leverages the data exchange standards efforts successfully implemented by DOJ's Global Justice Information Sharing Initiative (Global)[2] and extends the Global Justice XML Data Model (Global JXDM)[3] to facilitate timely, secure information sharing across the whole of the justice, public safety, emergency and disaster management, intelligence, and the homeland security enterprise.

NIEM complies with the Homeland Security Presidential Directive (HSPD-5)[4], which assigns the Secretary of DHS the role of principal federal official for domestic incident management. The Homeland Security Act of 2002[5] charges the Secretary with the responsibility for coordinating federal operations within the United States to prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies. In 2004, Congress passed the Intelligence Reform and Terrorism Prevention Act (IRTPA) and in 2005 Executive Order 13388 was issued by the President. Both items direct U.S. government organizations to strengthen the sharing of terrorism information between organizations and appropriate authorities of local and state governments and the protection of the ability of organizations to acquire this additional information.

1.3. How Does NIEM Differ From Global JXDM?

Several years ago, the state and local criminal justice community had a problem. Among law enforcement, courts, corrections, and other domains there was a need to share information rapidly and effectively to serve a variety of public safety needs. At best, this was an expensive process, involving point-to-point exchanges that were cumbersome to implement, site specific, and not easily modified or reused. The advent of Extensible Markup Language (XML) provided the tool with which information could be exchanged more efficiently and cost effectively. A multitude of independent and, as a result, incompatible initiatives to build XML solutions among justice agencies did not solve the problem of unifying all criminal justice organizations under a common XML vocabulary. Global sought to remedy this situation by bringing practitioners and developers together in order to build information exchange standards, based on sound principles and best practices.

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[1] The joint DOJ/DHS announcement was made at the executive session of the Global JXDM Developers' Workshop in Arlington, Virginia. See http://www.it.ojp.gov/topic.jsp?topic_id=195.

[2] The DOJ's Global Justice Information Sharing Initiative (Global) serves as a Federal Advisory Committee (FAC) to the U.S. Attorney General on justice information sharing and integration initiatives. Global was created to support the broadscale exchange of pertinent justice and public safety information. It promotes standards-based electronic information exchange to provide the justice community with timely, accurate, complete, and accessible information in a secure and trusted environment. More information about this initiative can be found at http://www.it.ojp.gov/topic.jsp?topic_id=8.

[3] The Global Justice XML Data Model (Global JXDM) is a comprehensive product that includes a data model, a data dictionary, and an XML schema that together are known as the Global JXDM. The Global JXDM is sponsored by DOJ's Office of Justice Programs (OJP), with development supported by the Global XML Structure Task Force (GXSTF) which works closely with researchers at the Georgia Tech Research Institute (GTRI). More information on the Global JXDM can be found at http://it.ojp.gov/topic.jsp?topic_id=43.

[4] More information on HSPD-5 can be found at http://www.whitehouse.gov/news/releases/2003/02/20030228-9.html.

[5] More information on the Homeland Security Act of 2002 can be found at http://www.whitehouse.gov/news/releases/2003/02/20030228-9.html.

The Global JXDM is unique within government as an XML vocabulary that has truly been created from the ground up. Practitioners from a variety of organizations came together to create a data dictionary that would allow the entire justice enterprise to share information with a common structure. This enables exchanges to be built that serve many purposes and eliminates the point-to-point inefficiencies of the past. The success of Global JXDM has standardized many disparate systems across the criminal justice domain and the concept is now being extended on a national level. Global JXDM will continue to operate under the guidance of DOJ Bureau of Justice Assistance (BJA), and NIEM will serve as an umbrella organization with a much larger scope. DOJ Office of the Chief Information Officer (CIO) is responsible for NIEM, in partnership with the DHS Office of the CIO.

In NIEM, the Global JXDM is represented in the Justice domain. NIEM not only includes the Justice domain but also represents others, such as intelligence and emergency and disaster management. NIEM provides the organizations involved in these domains with the data model needed to create their information exchanges, to create and share information, and to get a head start in implementing its own exchanges. NIEM actively encourages federal agencies while equally focusing on state and local contributors. This is possible through an emphasis on component-based resources that are reusable and portable to any organization or platform. NIEM will serve as an umbrella for existing domains, such as justice and homeland security, to work side-by-side in developing information exchange capabilities and ensuring that technology will never again be a barrier to the public's safety and well-being.

1.4. Why is NIEM Needed?

A variety of emergency situations in recent years have demonstrated in increasingly vivid detail the tragic consequences that often result from the inability of jurisdictions and agencies to effectively share information. Terrorist attacks, natural disasters, and tragic large-scale criminal incidents too often serve as case studies that reveal weaknesses in our nation's information sharing infrastructure. Even daily local events that involve multiple agencies, such as fire and law enforcement, illustrate the challenges to sharing information.

Citizens and decision makers alike largely believe that government organizations today can instantly share critical information at key decision points throughout the whole of the justice, public safety, emergency and disaster management, intelligence, and homeland security enterprise. Contributing to this problem is the false portrayal of such information sharing capabilities every day on television and in movies. Moreover, the level of integration that is possible today is evident in an ever-expanding array of online services in commercial endeavors and consumer products (e.g., eBay and Amazon.com). Surely, first responders should be able to share information and effectively communicate in emergency situations, when seconds count and lives are at stake.

Even though agencies perform similar operational functions, their internal business processes are inconsistent, and they continue to use different information systems and technology to support them. They lack a

NIEM Value Propositions:

- Improve public safety and homeland security.
- Enhance the quality of justice and decision making by providing accurate, timely, complete, and relevant information to decision makers across the broad spectrum of NIEM communities of interest (COIs).
- Provide return on investment (ROI) to practitioners and vendors by accelerating IEPD design and development.
- Facilitate business transformation.
- Provide the framework for expansion into other COIs.

national mechanism to identify and facilitate information exchanges with other agencies and jurisdictions. As a consequence, these agencies are unable to effectively share information in a timely, secure manner, and too often, there are fundamental differences in the nature and understanding of information between them.

NIEM is designed to serve as that national mechanism to support the creation and implementation of enterprise-wide information exchange standards so that organizations at all levels of government can effectively share and have access to information in an efficient and secure manner without changing their internal processes or systems.

Analysts and officers, for example, need the ability to perform simple queries that will interrogate their own internal agency information systems, as well as access other external agency information systems, as appropriate. NIEM is designed to facilitate this cross-domain, enterprise-wide information exchange by searching and returning a "hit" to the user and providing more detailed information. Because of security concerns and the sensitive nature of data contained in the variety of information systems engaged in NIEM, not all information will be routinely or broadly available. Data owners and originating agencies must have the ability to control access to information. U.S. Marshals, for instance, may want to share virtually all of the information they have on fugitives, while the Drug Enforcement Agency (DEA) may only want to share limited information regarding ongoing investigations. NIEM will help the technical personnel across the country set up this capability in a consistent way that is interoperable with partner agencies, and this capability must be equally available at all levels of government.

1.5. Understanding the Business Value of NIEM

Providing immediate access to timely, complete, and relevant information and sharing critical data at key decision points throughout the whole of the justice and public safety enterprise are key objectives of the NIEM program. Fundamentally, NIEM is not just about technology or making systems perform better. It is about making major improvements in the way information is shared throughout the nation.

The primary value propositions supporting NIEM include:

- Improving public safety and homeland security by enabling real-time and precise information access and exchange between communities of interest (COIs) at all levels of government. Because NIEM models, builds, and documents information exchange standards for enterprise-wide information sharing, operational agencies will be better equipped with proper information and more capable of making informed decisions that can translate into direct improvements in public safety and homeland security.
- Enhancing the quality of justice and decision making by providing accurate, timely, complete, and relevant information to decision makers across the broad spectrum of NIEM COIs.
- Achieving greater efficiency, effectiveness, and return on investment (ROI) in operations and decision making by providing users with a set of reusable data components, as well as the tools needed for discovering and developing common and universal data components for effective information exchange. NIEM will provide significant value to practitioners by accelerating information exchange design and development through effective discovery, reuse, and extension of operationally validated standards. It also means that the major investments local, state, tribal, and federal governments have already made in existing information systems can be leveraged and that they can efficiently participate in this national information sharing environment.

- Additional improvement in efficiency and effectiveness can be achieved through the application of standard methodologies for scenario-based planning, information exchange mapping and modeling, and IEPD development. In the future, existing databases will be made accessible to different sources via standard queries.
- Reducing the design and development time needed to build and implement robust, agile information sharing capabilities using NIEM's common standards, vocabulary, reusable data components, and tools. Additionally, NIEM will support a repository to host IEPDs and ensure interoperability between systems.
- Facilitating business transformation by identifying and documenting information exchange requirements among diverse COIs, building information sharing standards, and enabling reengineering of key operations, where effective.
- Providing a valuable framework, infrastructure, and governance that is scalable beyond the current domains for other cross-government information exchange challenges.

A comprehensive *Performance Management Plan* (PMP), to be developed by the NIEM Program Management Office (PMO), will include the requirements and processes for regularly documenting and measuring the core business value of NIEM in building information sharing capabilities in each of the dimensions noted above. It will include specific, objective, quantifiable metrics associated with the NIEM value propositions. Reports will be used to document the outcomes (actual results) of these measures by the appropriate governance bodies that oversee program resources to ensure they provide value.

1.6. Purpose of the CONOPS

This *Concept of Operations* (CONOPS) provides a high-level conceptual view of NIEM and its operations. The CONOPS is designed to introduce NIEM to decision makers, practitioners, users, and technical developers and to provide general descriptions of NIEM's objectives and value, operational and technical principles and processes, and the governance structure that will guide and manage this national program.

As shown in *Figure 1: Reading Road Map*, the CONOPS is the second document in a series of three recommended for stakeholder review. The *Introduction to NIEM* (the first document) is designed to provide a general description of the core capabilities of NIEM, the need for and value of NIEM as information sharing enabler, brief descriptions on how NIEM operates and is governed, and the near-term goals of NIEM. The primary target audience for the *Introduction to NIEM* is executives and policymakers. The *User Guide* provides detailed user instructions, more comprehensive discussion of technical architecture, standards and development life cycle, and outreach and support mechanisms and is targeted towards program managers and practitioners. Together, the documents described in *Figure 1: Reading Road Map* provide the information stakeholders need to understand and implement the core capabilities of NIEM. Other supporting documentation, such as the *NIEM Naming and Design Rules* (NDR) and the *IEPD Specification*, can be found in the document library on www.NIEM.gov.

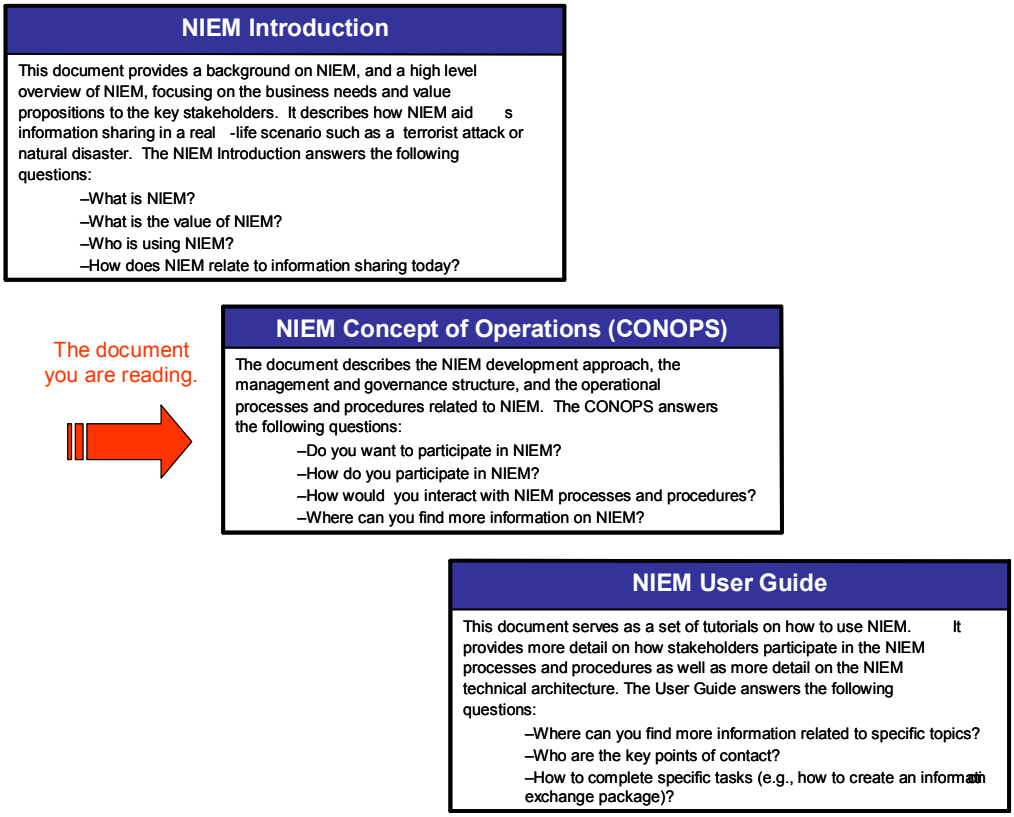


Figure 1: Reading Road Map

The CONOPS is broken out into the following chapters:

- *Chapter 1* provides an introduction and overview and on NIEM, its business value, and how it is different from Global JXDM.
- *Chapter 2* describes the core business concepts behind NIEM, including collaboration with stakeholders, business domains, COIs, understanding business scenarios, and the NIEM data components.
- *Chapter 3* provides an overview of the NIEM governance structure and interactions between the governance entities.
- *Chapter 4* describes the key technical concepts behind NIEM, including the NIEM data model, architecture, modeling concepts, and support for development of IEPDs.
- *Chapter 5* identifies the tools and training available to stakeholders.
- *Chapter 6* describes the operational processes behind NIEM, including COI-related processes, IEPD development, and practitioner-related processes. It also describes support processes, such as configuration management, quality assurance, issue resolution, and model updates and management.
- *Appendix A* summarizes the NIEM governance roles and responsibilities.
- *Appendix B* provides a list of terms and definitions.
- *Appendix C* provides a list of acronyms.

2. NIEM'S BUSINESS CONCEPTS

2.1. Collaborative, Practitioner-Driven Approach to NIEM

Operational stakeholders and practitioners from all levels and branches of government are directly involved in NIEM. Private sector solution providers also continue to be equal providers in NIEM through the various representative organizations, such as Integrated Justice Information Sharing (IJIS), Organization for the Advancement of Structured Information Standards (OASIS), and the Emergency Interoperability Consortium (EIC), etc. The active involvement of these business and technical representatives will ensure operational integrity and a comprehensive perspective in the standards being developed. They play critical roles in developing, validating, and implementing NIEM-supported standards, as well as recommending new NIEM content and support and development processes and tools. More information on their involvement is described in Chapter 6.

2.2. Understanding Business Domains

NIEM is currently comprised of several key domains representing the broad justice, public safety, emergency and disaster management, intelligence, and homeland security enterprise. A *domain* can be defined as "a sphere of activity, concern, or function."[6] For purposes of NIEM, a domain refers to a business enterprise broadly reflecting the COIs, agencies, units of government, operational functions, services, and information systems which are organized or affiliated to meet common objectives.

One such domain currently engaged in NIEM is *Justice.* The *Justice* domain includes governmental and quasi-governmental agencies whose functions relate to the reporting and investigation of crime, the apprehension of suspected offenders, the provision of services to victims and the general public, prosecution of those charged with criminal offenses, adjudication, pretrial services, judicial processing and sentencing, and correctional confinement and supervision, among others. The *Justice* domain encompasses such *disciplines* as law enforcement, prosecution, defense, correctional supervision (both institutional and community supervision), and the judiciary.[7]

The boundaries of these domains and disciplines, however, are fairly elastic. *Justice*, for example, may appear to be a tightly knit *domain*, but in reality, it includes different branches of government (executive and judicial branches), different levels of government (municipal, county, state, tribal, and federal), as well as agencies, organizations, and units of government who, by constitutional design, are sometimes adversarial in their relationships and operate entirely independently of one another. Nevertheless, the agencies and organizations operate in a loosely federated environment to facilitate common processes and necessarily share information as part of their routine business processes. Similarly, law enforcement, from some perspectives, might appear to be a tightly knit *discipline*, as it typically involves agencies and organizations whose responsibilities include enforcing laws, maintaining public order, bringing offenders and suspects to justice, responding to public emergencies, and enforcing court orders, among other duties. But it must be recognized that there is a broad range of agencies that shoulder these responsibilities, ranging from local police departments and sheriffs to federal drug enforcement agents, from game and fish wardens to secret service agents, from school resource officers to local SWAT team members.

[6] www.wikipedia.org.
[7] Other such disciplines, for example, may include pretrial services, drug treatment programs, and victim service units.

While agencies and organizations can be effectively organized into such general business domains as justice, public safety, emergency and disaster management, intelligence, and homeland security, it must be remembered that even within domains there are significant variations in the nature, responsibilities, and structure of participating members.

Domains currently addressed in NIEM include Justice, Intelligence, Immigration, Emergency Management, International Trade, Infrastructure Protection, and Information Assurance.[8] As success is achieved and demonstrated in these domains, it is anticipated that other domains, such as Health and Human Services and Transportation, may also participate in the development and utilization of NIEM standards.

2.3. Communities of Interest (COIs)

Communities of Interest (COIs) are collectives of people comprised of practitioners and technical representatives (government and private sector) who, by virtue of their organizational affiliation, day-to-day operational responsibilities, or their provision of services and programs collectively, have a stake in NIEM information exchanges and who authoritatively represent their respective domains. Generally, COIs are formally constituted through an organizational charter, memorandum of understanding (MOU), articles of incorporation, or the Federal Advisory Committee Act (FACA).[9]

These *stakeholders* may be members of a single COI or multiple COIs, depending on their interests and involvement. COIs can reuse data components and IEPDs and offer content into any domain. Additionally, multiple COIs can coordinate to develop new domain content. COIs typically meet, either personally or virtually, to articulate and define their business requirements and to plan, map, and model their inter- and intradomain information sharing requirements.

2.4. Scenario-Based Planning

NIEM does not attempt to normalize all information systems or standards across relevant domains. NIEM is predicated on identifying operational information exchanges among participating domains by examining current practice (i.e., documenting business requirements for information exchange between agencies and domains) and by modeling new and innovative information exchange opportunities to achieve greater efficiency, effectiveness, ROI, and new operational capabilities.

Not all information an organization collects needs to be shared with other organizations or domains. Identifying precisely what information is exchanged between organizations can best be determined by modeling relevant business practices of the domains through scenario-based planning and information exchange mapping.

Organizations define information exchanges to support the sharing of information in real-life scenarios. Scenarios describe the business context of events, incidents, or circumstances in which information must be exchanged between agencies and/or domains. The scenario may be a terrorist attack on a city, a natural disaster, a major criminal incident requiring response by

[8] The Justice domain is largely represented in NIEM by the Global Justice Information Sharing Initiative: http://www.it.ojp.gov. The Emergency Management domain is largely represented by the OASIS Emergency Management Technical Committee: http://xml.coverpages.org/emergencyManagement.html#oasis. The Intelligence domain is largely represented by the Intelligence Community Metadata Working Group: https://www.icmwg.org/. The Critical Infrastructure Protection Initiative is largely represented by the Open GIS Consortium: http://www.opengeospatial.org/.

[9] More information regarding the Federal Advisory Committee Act can be found at http://www.archives.gov/federal-register/laws/fed-advisory-committee/. Organizational charters for other COIs can be found at http://xml.coverpages.org/emergencyManagement.html.

multiple agencies or jurisdictions, or simply the day-to-day operations of justice, public safety, and homeland security agencies at all levels of government.

Careful elaboration of business scenarios can identify critical operational points at which information must be shared between two or more parties for effective prevention, response, and remediation. Scenarios can be used to depict current information exchange practices among involved parties, thereby identifying gaps, impediments, and other flaws in business processes and data exchange. They may also be used to characterize potential future environments that envision broader and more expansive information sharing, as well as changes in business practice.

An example scenario demonstrates the breadth and scope of information sharing requirements in operational settings:

U.S. Border Patrol agents view a map of the area, displaying fixed locations such as landmarks and roads, agent locations, and the status of seismic sensors, on a vehicle-mounted or, when away from their vehicle, handheld device.

When sensor activation is displayed on the map, the nearest agent indicates that he will respond to it. The responding agent approaches the location and encounters a group of suspected undocumented migrants. He identifies himself as a U.S. Border Patrol agent and apprehends the majority of the group, but two men in the group escape. The agent radios a description of the two men and their direction, and the approximate last known position of the "got aways" is entered on the map so that other agents in the field can view it. A search is coordinated for the two migrants.

Meanwhile, information from a citizen's call about two suspected undocumented migrants loading into a pickup is entered on the map. The closest mobile unit pulls in behind the pickup. The agent immediately runs searches concerning the vehicle license plates, and after receiving positive results on the records checks, a traffic stop is affected.

The agent begins to question the driver and the two passengers and notices that the passengers match the description of the two "got aways" reported earlier. He runs the name and identification of each passenger in a federated query against local, state, and federal databases. The rapid response comes back with a positive history of immigration violations, as well as records of criminal violations. With probable cause established, the three men are taken into custody for further processing. When their fingerprints are run and other national databases are checked, one of the prisoners is found to be on a Terrorist Watch List, under a different name and identification.

As this scenario demonstrates, immediate, secure, enterprise-wide information sharing and interoperable communications are required to support critical justice and public safety operations and to facilitate tightly coordinated response across multiple agencies, domains, and jurisdictions. Without the benefit of information sharing, the officer may not have obtained probable cause needed to take the men into custody and a potential terrorist could have gone free. All of the information queries and responses in this example could occur using standard NIEM-conformant messaging.

Similar scenarios can easily be constructed to demonstrate the range of information sharing that is inherent in the daily operations of border enforcement, passenger screening, port security, intelligence analysis, local law enforcement and judicial processing, correctional supervision and release, and other governmental functions. DHS has developed fifteen scenarios addressing a range of emergency situations, from nuclear detonation to cyber attack, requiring coordinated

response, though they do not specifically address information sharing requirements.[10] Other scenarios are being documented and will be available on NIEM.gov.

Using scenario-based planning, COIs can document their business requirements and complete their information exchange mapping and modeling. This process is further described in Chapter 6.

2.5. NIEM Data Components

Rather than nationwide integration of all local, state, tribal, and federal databases, NIEM focuses on cross-domain information exchanges between COIs across all levels of government. As a consequence, not all data needs to be NIEM-compliant, only that data that is being shared across domains.

To effectively exchange information across domains, there must be a common semantic understanding of data among participating agencies, and the data must be formatted in a semantically consistent manner. For example, two agencies may each gather information about persons charged with committing a crime. If the agencies share information regarding these persons, there must be a common understanding of the terminology each agency uses. One agency, for example, may refer to the person as the "offender," while another refers to them as the "defendant." Agencies do not necessarily need to entirely retool their information systems or adopt standards and coding schemes that impose an artificial uniformity in data collection that fails to meet their operational business needs, but there must be a common understanding and semantic consistency in the structure of the data that crosses agency lines, if it is to be successfully shared.

The fundamental building block of NIEM is a *data component*. Data components are the basic business data items that describe common concepts used in general business activities.

Information that is exchanged between agencies can be broken down into individual components—for example, information about people, places, material things, and events. Data components within an information exchange commonly shared and understood among all domains are identified as *universal (U) components* (e.g., person, address, and organization), while components used in exchanges between multiple domains, but not universally shared, are identified as *common (C) components* (e.g., offense, sentence, and disposition). Components managed by a specific COI (e.g., appellate case decision and arrest agency) are considered *domain-specific*. *Figure 2: NIEM Universal, Common, and Domain-Specific* Components represents the NIEM component architecture.

[10] The Homeland Security scenarios can be found at http://www.globalsecurity.org/security/ops/ter-scen.htm.

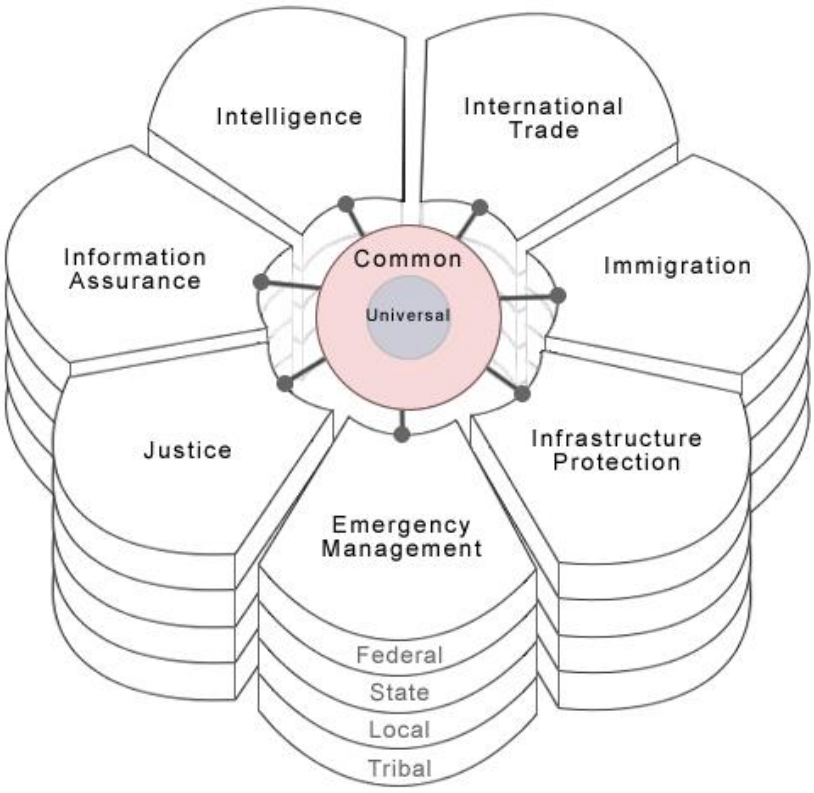


Figure 2: NIEM Universal, Common, and Domain-Specific Components

By identifying common and universal information exchange components and building broad information sharing capabilities, NIEM will transform the way justice and public safety agencies do business and provide real-time, secure, enterprise-wide information exchange. First responders must be assured they can base decisions on timely, accurate, and complete information from a variety of sources. Creating, adopting, and adhering to NIEM standards will remove barriers to information sharing and will reduce the design and development time needed to build and implement robust, agile information sharing capabilities, using NIEM's common standards, vocabulary, reusable data components, and tools. The common and universal component concepts will relieve agencies from the responsibility to define basic, well-understood terms, while leaving them with flexibility and authority over those components that are specific to their business domain.

A data component, such as a *person*, represents a composite of attributes which describe something of interest—in this case, a *person*. The component may include such attributes as the person's name, date of birth, sex, race, ethnicity, height, weight, eye color, hair color, body type, etc. The *person* component is used in nearly all of the relevant domains in NIEM and carries the same meaning across all the COIs. Thus it is classified as universal.

As shown in *Figure 3: Component Reuse*, each NIEM domain can extend universal for its own use, and *person* may have different attributes within these other domains. In this simplified illustration (where the arrows indicate content), the *person* component used in universal, identified as U:Person, is extended by the addition of other components in the justice domain forming J:Person, and J:Person is similarly extended to IM:Person in immigration.

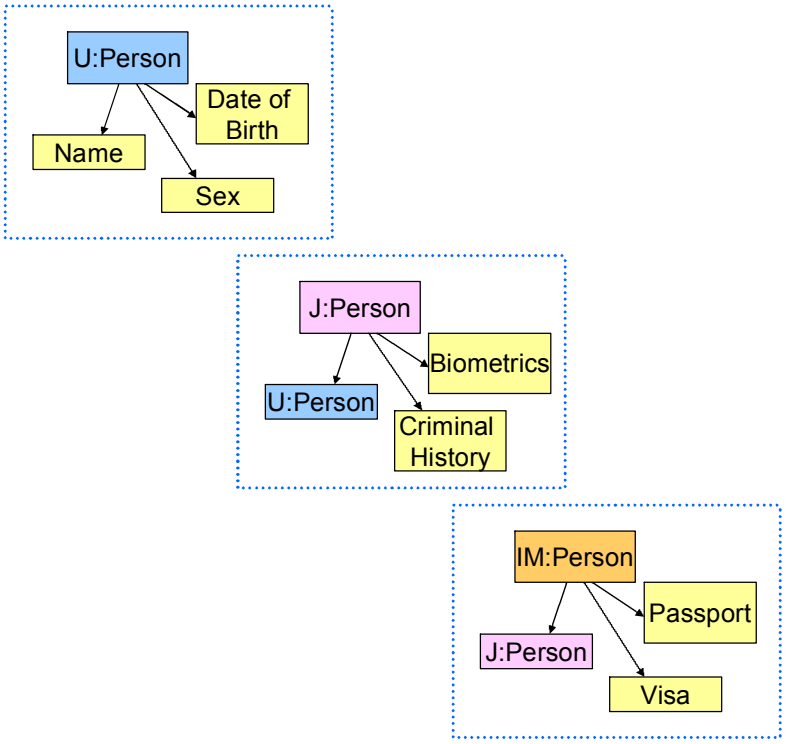


Figure 3: Component Reuse

Once the *person* component has been defined and validated for operational use, it can be stored in NIEM and made readily available for discovery, reuse, and extension by other interested COIs. As a consequence, COIs need not spend the time and effort ordinarily required to construct a component from scratch, and it facilitates greater information sharing, making connections more expansive and expedient.

The full collection of information exchanged between agencies can be captured in an information exchange. For example, information regarding the arrest of a person will include not only descriptive and personal identification data regarding the individual—the *person* component described above—but also information about their alleged offense, the location of the offense, arresting officer, etc. An information exchange supports a specific set of business requirements in an operational setting. Additional information regarding this specific exchange can be further documented in the form of an IEPD, with data describing the structure, content, and other artifacts of the information exchange.

As COIs develop and extend these universal and common components, they will be able to use them for domain-specific exchanges, effectively independent of NIEM, as well as to add extended content to NIEM for further use/reuse in cross-domain information exchanges. As COIs build new cross-domain information exchanges, this will likely identify additional common and universal data components for NIEM.

IEPDs include:

Exchange specifications, such as schemas, want lists, and style sheets.

Documentation, such as business requirements, memorandums of understanding, domain models, use-case models, and business rules.

IEPD specifications, including the manifest (list of artifacts in the IEPD) and the metadata registered with the IEPD.

Through communication, outreach, and governance, stakeholders will be brought together to elaborate information exchange scenarios; map and model information exchange requirements; and will be provided with the operational methods, tools, and support services for development of their domain-specific components.

3. NIEM ORGANIZATION AND GOVERNANCE

NIEM provides the data model for multiagency information sharing. Intergovernmental groups representing key stakeholders play an important role in creating and sustaining partnerships. Partners can share knowledge and resources across the government and ensure that NIEM provides true value to citizens.

Broad-based participation is critical to provide needed vision and effective decision-making direction for NIEM. Representatives from all relevant COIs, spanning all levels of government, can participate in NIEM.

Stakeholders participating in NIEM include executives, practitioners, program managers, subject-matter experts, technologists, product developers, academia, standards bodies, sponsors, media, and private industry—each of whom bring unique perspectives and contribute important content to the NIEM development efforts. These stakeholders comprise the COIs responsible for developing, harmonizing, and managing the data components found in NIEM.

COI stakeholders are invited to participate in the NIEM governance structure, and roles and responsibilities are further described below and in Appendix A.

3.1. NIEM Governance Structure

Because of the inherent complexity of issues and the constitutional separation of powers that are present, an organizational structure is a necessary first step to ensure that the stakeholders are intimately involved in the project. The NIEM governance structure is illustrated in *Figure 4: NIEM Governance Structure*. A summary description of each of these entities is provided below, while more detail is provided in Appendix A.

- *Advisory Committee:* Serves as a vehicle for the communities to provide input to NIEM and provides recommendations and feedback to support the PMO and ESC.
- *Business and Outreach Director:* Responsible for developing working relationships with stakeholders at all levels of government and directing the NIEM Business Architecture Committee (NBAC).
- *Communications and Outreach:* Provides a network for practitioners (advisory and stakeholder members with a shared interest and expertise) and has the responsibility for implementing communications and outreach plans including training and technical assistance planning.
- *Development Team:* Implements the appropriate technological solutions to improve the effectiveness and efficiency of NIEM.
- *Executive Director:* Provides vision and leadership to the NIEM PMO and ensures internal and external communication with stakeholders.
- *Executive Steering Committee:* Represents the key public decision makers from all jurisdictions with a significant vested interest and invested resources in NIEM objectives.
- *Help Desk:* Assists NIEM stakeholders with any issues that arise (e.g., referring them to the proper communication tool for a documentation request, providing support on NIEM processes, and alerting the Development team if technical issues arise with any NIEM tools.)

- *NIEM Business Architecture Committee (NBAC):* Led by the Business and Outreach Director and composed of information sharing and business architecture subject-matter experts (SMEs) to advise practitioners, COIs, and the NTAC.
- *NIEM Technical Architecture Committee (NTAC):* Led by the Technical Director and comprised of information sharing and technical architecture SMEs to advise the development team and the NBAC.
- *Operations Director:* Responsible for delegating and assigning resources to resolve NIEM program issues.
- *Policy Advisory Panel:* Makes recommendations to the PMO on political, organizational, legal, technical, cultural, and personnel issues and oversee the day-to-day operations of NIEM.
- *Program Management Office:* The NIEM Program Management Office (PMO) represents the operational arm and support for the NIEM Program. The PMO includes not only the NIEM executive director, but also the business and outreach director, the operations director, and the technical director, as well as the operational staff.
- *Program Staff:* Operational body responsible for the daily implementation of NIEM processes.
- *Stakeholder Panel:* Consists of members that have a stake in or may be impacted by a given approach to NIEM and advises the executive director on stakeholder issues.
- *Technical Director:* Responsible for the planning and management of the technical aspects of NIEM and directing the NIEM Technical Architecture Committee (NTAC).

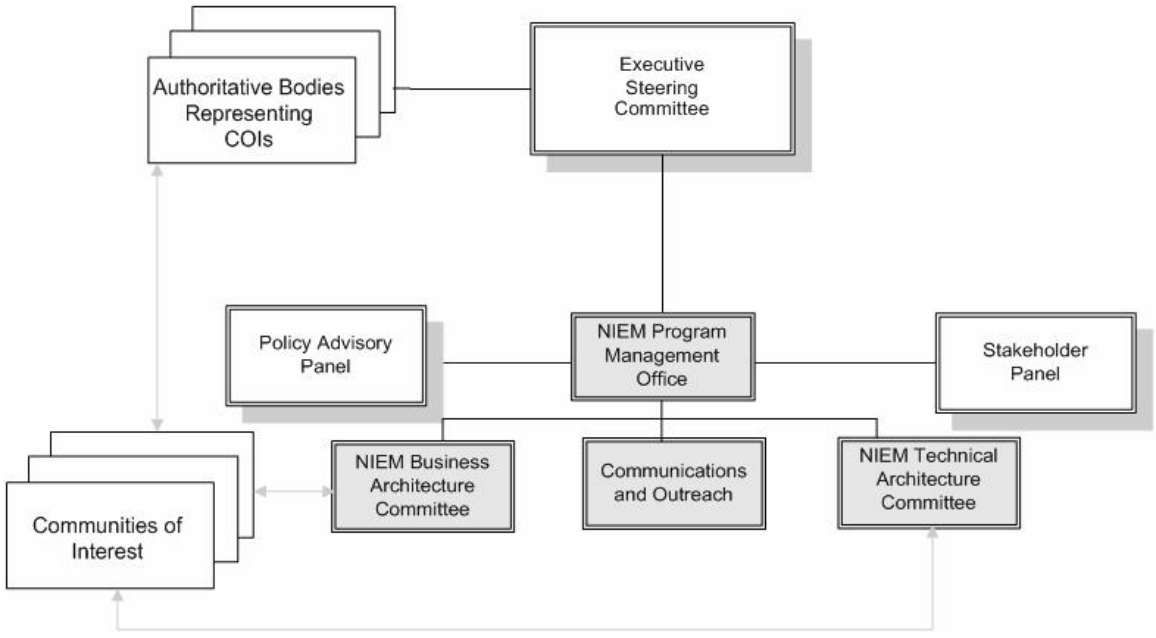


Figure 4: NIEM Governance Structure

3.2. NIEM Governance Roles and Responsibilities

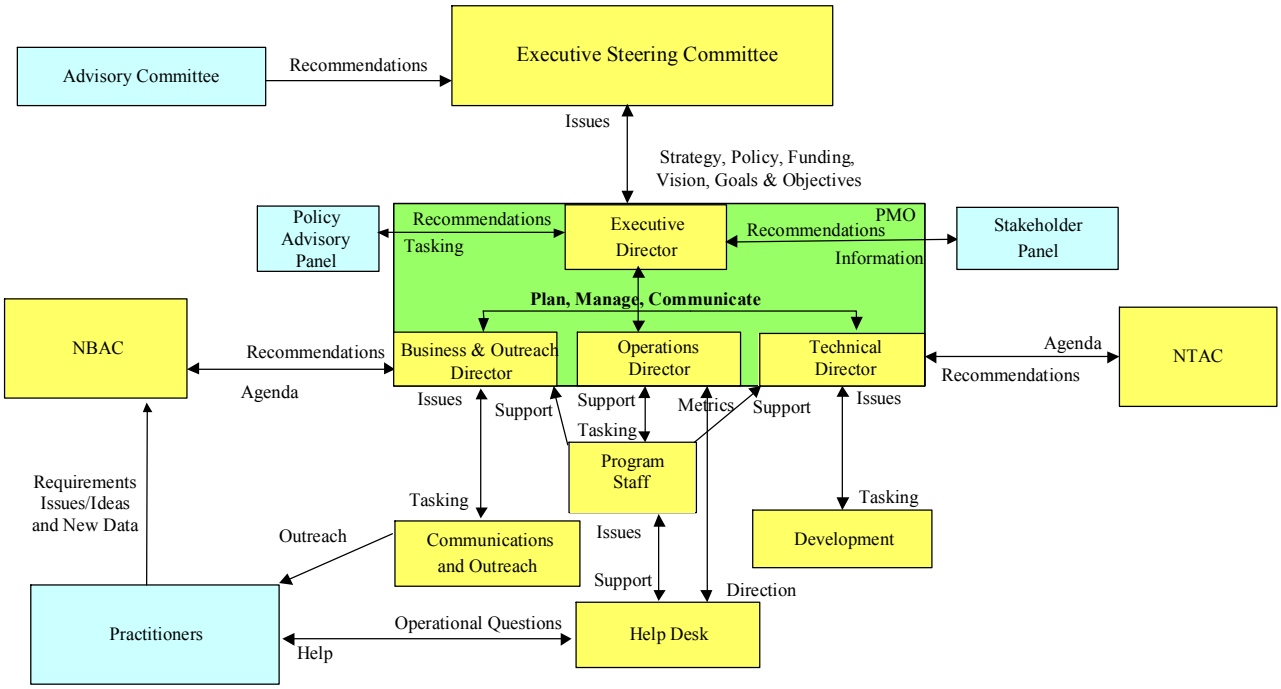
Defining a governing body is one of the key components to planning and implementing a successful NIEM. The NIEM governance structure serves as the vehicle through which

agencies, stakeholders, and users participating in the NIEM Initiative are assured representation. *Figure 5: NIEM Governance Interactions* represents governing interaction between the entities.

The Advisory Committee provides recommendations to the ESC on business and technical issues. The ESC sets the strategic direction, funding, and policies for NIEM and works with the executive director to do so.

The executive director works closely with the Policy Advisory Panel to identify the legal, policy, administrative, funding, and technical requirements to achieve the NIEM goals and objectives. The executive director works with the Stakeholder Panel to collect and evaluate information related to their respective communities and determine any possible impacts of NIEM on their operations. The executive director also oversees the NIEM PMO and directly manages the business and outreach director, the operations director, and the technical director. Each of these directors oversees their respective staff (i.e., communications and outreach, program staff, development team, and help desk). These directors assign work to their staff and assist their staff in dealing with any issues related to their assigned tasks. The business and outreach director serves as the liaison to state and local business entities and also has the responsibility to ensure the smooth operation of the NBAC. Similarly, the technical director has the responsibility to ensure the smooth operation of the NTAC.

Practitioners receive communications from the Communication and Outreach staff. If they have issues, such as where to find a specific document or how to use a tool, they contact the NIEM Help Desk. For assistance in areas such as understanding an IEPD developed by a specific COI, the practitioners would work with the NBAC.



PMO - Program Management Office

NBAC - NIEM Business Architecture Committee

NTAC - NIEM Technical Architecture Committee

Figure 5: NIEM Governance Interactions

4. NIEM TECHNICAL CONCEPTS

Conceptually, NIEM is a data model providing the reference vocabulary for consistent and repeatable interagency and interdomain exchanges of information. The model is one internal representation of NIEM that combines the standard structures with the data dictionary. Other external representations include the XML schemas and the spreadsheet (see section 5.2). NIEM includes the body of concepts and rules (see *NIEM NDR*) that underlie its structure, maintain its consistency, and govern its use.

NIEM uses XML schema as its rendering language. The structure and meaning of the data is defined by the model and dictionary and then rendered or represented as XML schema, thereby providing a common framework for information exchange.

The model's unique architecture enables data components to be constrained, extended, and augmented, as necessary, to formulate XML exchange schemas and XML instance documents defining the information payloads (content) for data exchange. These exchange-defining documents are packaged in IEPDs that are reusable, modifiable, and extendable. *Figure 6: NIEM Technical Concepts* illustrates the concepts described throughout this chapter.

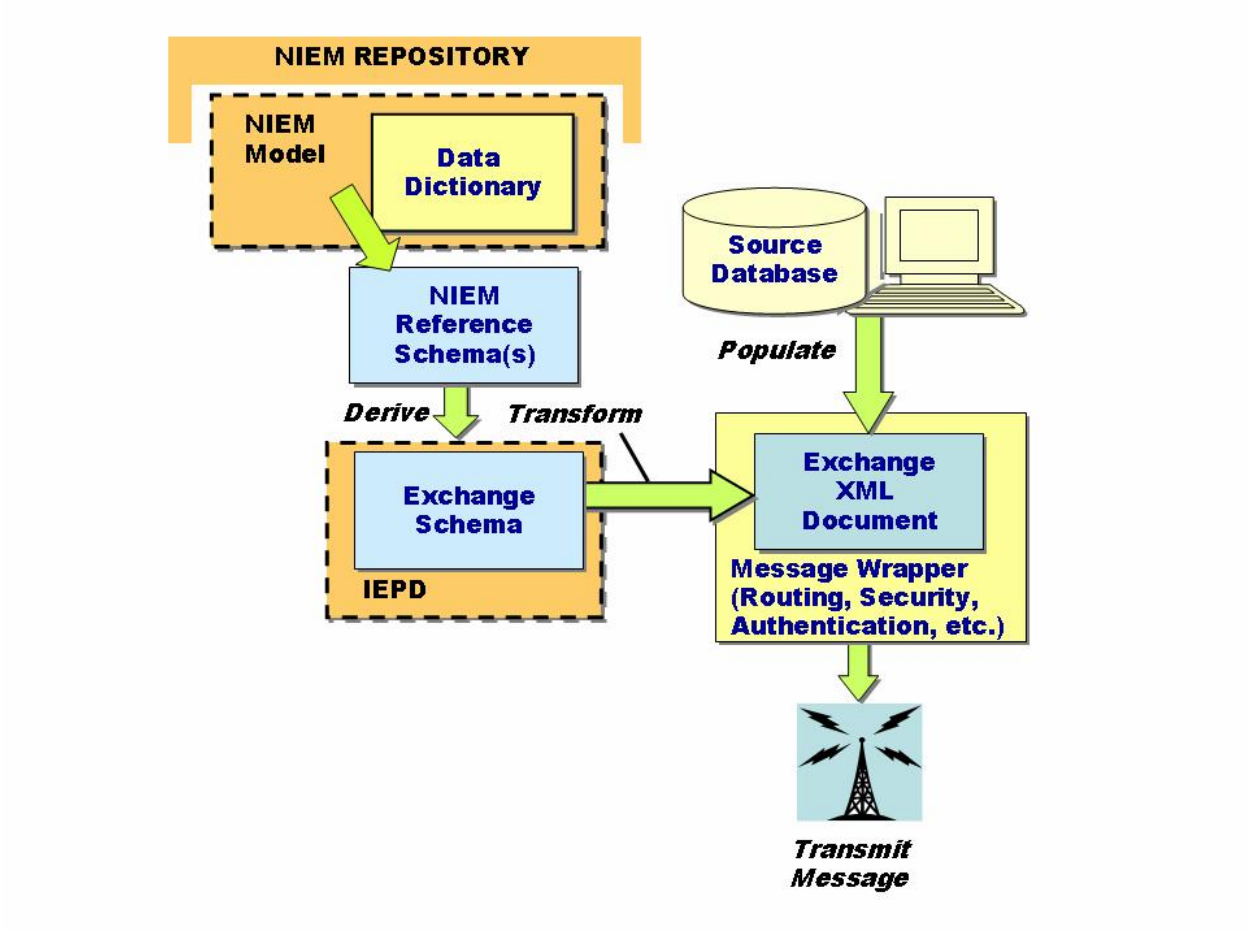


Figure 6: NIEM Technical Concepts

4.1. NIEM Data Model

The NIEM data model is described below in terms of its characteristics and its component artifacts.

4.1.1. Technical Standards

The *NIEM NDR* rules and principles establish and, more importantly, enforce a degree of standardization in NIEM. Nonessential features that inhibit preciseness and restrict interoperability are precluded. For example, the developers apply selected object-oriented programming (OOP) features to maximize efficiency through extension and consistent reuse of properties and types.

NIEM adopts standard schema constructs and methods, such as roles, associations, and augmentation (see Section 4.3), from industry standards such as World Wide Web Consortium (W3C) XML schema language.

Adherence to the basic XML schema language facilitates the building of NIEM-conformant components from non-NIEM-conformant data objects. Its reference and import features save time and effort in dealing with existing standard and legacy data by enabling use of components from an external standard schema or namespace, even though they do not conform to the NIEM *NDR*.

NIEM supports the use of codes tables. The code tables in NIEM are enumerated values for coded data elements, a simple example of which is a list of states. Every coded data element has a set of code values (e.g., a two-letter abbreviation for a state such as MD). If the values themselves are not self-evident, then they may also have corresponding literals or definitions. For example, “Maryland” is the literal for the code value “MD.”

4.1.1.1. Multiple Representations

The NIEM model is essentially independent of any particular technology. While it is described in this CONOPS in terms of the currently preferred XML schema and Excel spreadsheet representations, it could be depicted in any number of different representations, which would produce semantically consistent interoperable information sharing. It is anticipated that future versions may migrate to new and evolving forms.

4.1.1.2. Requirements-Based

NIEM is business requirements driven. Its content requirements are dictated by the need to exchange data among existing and planned data systems and data models and government agency business disciplines at the local, state, tribal, and federal levels.

4.1.1.3. Extensibility

The NIEM architecture (see section 4.2) is flexible and extensible without compromising existing semantic relationships. New components that are required for exchange but are not yet contained in NIEM can be constructed using one of several methods and then relating them to existing components. Components can be used in multiple domains and in different contexts. NIEM can also leverage components and code values defined in other external data standards.

4.1.1.4. Version Retention

Another salient feature of the NIEM model is that it is backwards compatible, so that exchanges based on earlier versions will not become obsolete.

4.1.2 Schemas

XML schemas express shared vocabularies and allow computers to follow precise business rules. An XML schema defines and dictates what content is permitted in an XML document and is able to automatically determine—via validation—if the contents of an XML document are acceptable and in proper order/relationships. Schemas may be quite general, but they may also be very exact and sophisticated in defining the content of an XML document. With its ability to

represent hierarchical relationships and its extensibility, XML provides a powerful method for representing complex collections of data.

The NIEM reference schemas are a set of interrelated schemas where each schema defines its own target namespace. Schemas in the reference set import one another by namespace in a standard order such that the reference set represents the full set of data components in all NIEM namespaces. For example, the NIEM Common namespace imports Universal. Furthermore, a domain reference schema imports Common and possibly other domain namespaces. The reference schema set is not for just one document but for all documents within its business context purview.

There is no support for user customizations in the reference schema(s). Customization occurs in the IEPD development process by extending and constraining a subset schema with other types of schemas applicable to NIEM, including extension and constraint schemas. Customization for a specific type of data exchange culminates in a document (or exchange) schema, which captures the results of subsetting, extending, and constraining in a schema that articulates the data tags for the data exchange message. These schemas are not part of the reference schema per se, but they are derived from the reference schema or act in conjunction with it as follows:

- *Subset schema:* Extracts from the reference schema set just those types and elements needed for a specific information exchange. A message instance that validates against the subschema must also validate against the full reference schema set.
- *Extension schema:* Defines an information exchange package (IEP)-specific namespace to hold types, elements, and attributes needed for the IEP but that are not in NIEM. Its purpose is for reusability of components and easier document schema creation. Additionally, it allows for the inclusion of local elements not found in the model and enables the extension of the document schema to include those local elements.
- *Constraint schema:* Adds certain additional constraints or restrictions to the types and elements in the subset. This type of schema is different than the others because it is not bound by the design principles of the reference set. Constraint schemas do not have to be NIEM-conformant. A constraint schema is usually a subset schema that has been modified by applying constraints that could not be applied to the subset without violating conformance.
- *Document schema:* Defines the content model of the IEP.

Each layer of schemas adds to the ultimate end-to-end interoperability between systems and decreases the cost and time needed for development and implementation. The subset and document (also called exchange) schemas are mandatory for IEPDs. The extension and constraint schemas are optional.

4.1.3. Data Dictionary

The NIEM data dictionary is a representation of the model in human reader-friendly spreadsheet form. It is a well-defined vocabulary of data terms and structures, containing all the elements of the reference model and their relationships within the model hierarchical structure. NIEM data components may be types (objects), properties, attributes, or associations. All are named and defined according to the guidelines for data naming and definitions in ISO/IEC Standard 11179 (Metadata Registries).

4.2. NIEM Architecture

The NIEM architecture is described in terms of domains and the XML namespaces that are assigned to each. A namespace is a mechanism for uniquely identifying and associating terms with a specific vocabulary. All globally defined components in a given namespace must be uniquely named. However, namespaces allow different globally defined components (each in a different namespace) to exist with identical base names while still distinguishing them (through namespaces). It is the solution to naming conflicts in XML.

As shown in *Figure 7: NIEM Namespace Architecture*, NIEM consists of two classes of namespaces: core and domains. NIEM also uses separate namespaces for code tables.

Core namespaces contain data components that are under NIEM configuration control. Domain-specific namespaces are organized by domain and are controlled by representatives from COIs participating in the domain. Core consists of universal, common, and structures.

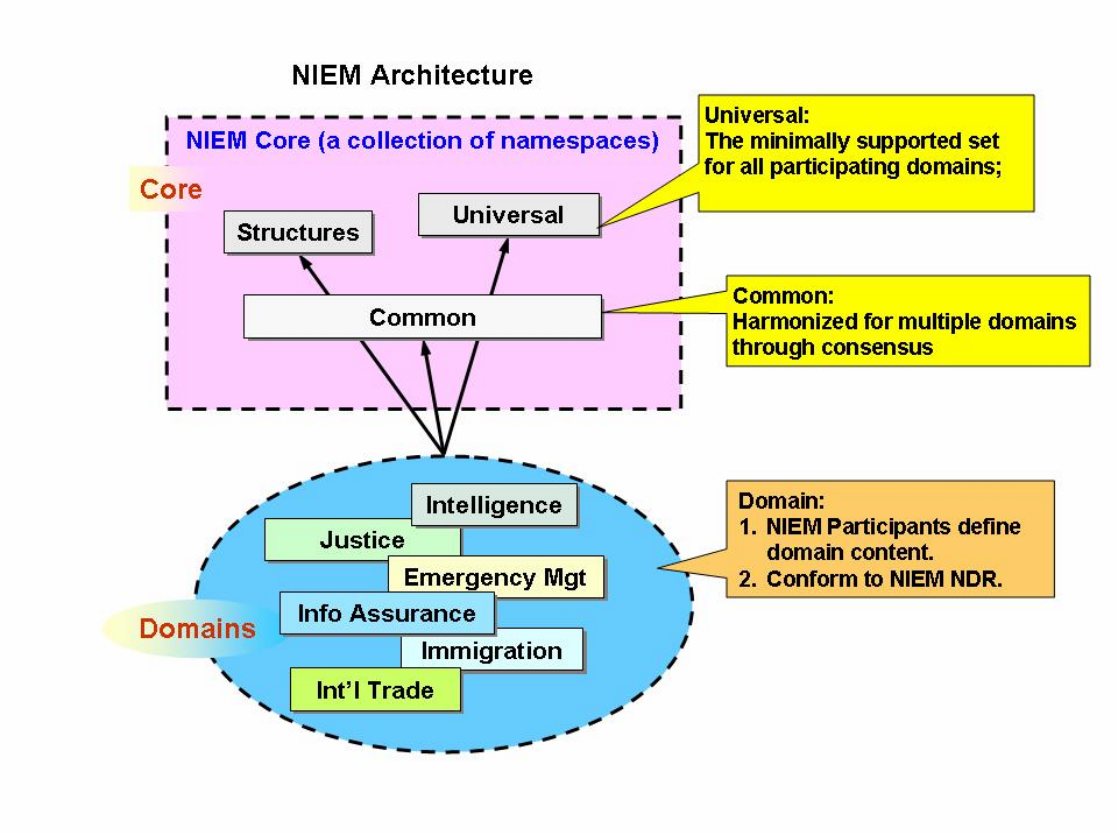


Figure 7: NIEM Namespace Architecture

- *Universal* is the minimal set of components harmonized for and supported by all domains participating in NIEM. This set of components is universally understood, stable (once established), and relatively small.
- *Common* contains components that are harmonized for and used regularly by multiple domains. Components are approved to be added to this namespace upon consensus on the common semantics and structure for each such component. A NIEM domain may be considered authoritative for a component and, therefore, not all components used by more then one domain must be in common. However, a component in a

domain must not semantically conflict or overlap with any other component in universal, common, or domain-specific.

- *Structures* contains components that do not carry information content or have specific semantic meaning but are imported into other namespaces to be used for associations and other supporting infrastructure.

Components in any domain may be used by any NIEM participant but do not require harmonization in Universal or Common because they do not currently overlap or conflict with other components in NIEM. Participating COIs are not required to move their entire data model or all of their data components into a NIEM domain. However, all components integrated into NIEM domains must conform to the *NIEM NDR*, methodologies, and architectural specifications.

4.3. Modeling Concepts

4.3.1. Data Elements

XML elements are the fundamental building blocks of XML schemas and documents. They are composed of a start tag, content, and end tag and can contain other elements and/or text data. An object's attributes are said to describe the object. The NIEM data model types become XML schema types and the NIEM properties become XML elements and attributes.

4.3.2. Classes, Types, and Properties

As mentioned previously, NIEM uses concepts originating from OOP. OOP defines a class as a specific entity in the data model, which may represent a real-world object but may also represent any conceptual object, such as relationships and messages. In XML, classes are represented as types. Properties are specific characteristics for an instance of a type. They describe a relationship between two components and may take the form of content or reference elements.

There is an array of technical mechanisms supported within NIEM to support building new components to meet specific requirements by reusing existing NIEM components. These mechanisms include composition, specialization with inheritance, associations, roles, type augmentation, and metadata. Each is briefly described below and more detail on each mechanism can be found in the *NIEM User Guide* and the *NIEM NDR*.

4.3.2.1. Specialization with Inheritance

Specialization is used when a base object class (type) contains or can be subcategorized into a more specific subclass. When this can be done, the subclass derived from the base class inherits the properties of the more general base or parent class. This mechanism is used to share or reuse properties between the general component and its specialization. For example, a vehicle type (or class) is identified as a component with properties of vehicle identification number (VIN), make, and model. Truck type (or class) is a specialization of vehicle and thus inherits the vehicle's properties but would also have its own characteristic properties, such as truck bed length. Specialization is time independent and is generally only used when the base class and subclass exist always.

4.3.2.2. Roles

A role is a special type which represents a particular function, purpose, context, or activity for an entity. Roles are generally time-dependent and, therefore, temporary. A new type can be created for a role, when the role has specific data associated with it and its own life cycle. A role type has a property, role-of, which indicates what object is assuming this role. A single entity may assume multiple roles. For example, many different entities may assume the role of a weapon. Therefore, if a vehicle is used as a weapon (to attempt to injure or kill a person),

then an instance of WeaponType would contain the property, role-of, which references (links to) the vehicle instance used as the weapon. The WeaponType (the role) might also contain properties that describe the persons and activities involved, dates and times of involvement, and how the entity was used as a weapon.

4.3.2.3. Associations

An association type is an object that represents a relationship between components. For example, two person type instances, Abigail and Bob, could be referenced by a MarriageAssociationType to represent the fact they are married. The MarriageAssociationType could contain its own properties, such as date of marriage, number of children, date of divorce or death of one spouse, etc.

4.3.2.4. Augmentation

An augmentation is the addition of domain or model specific information about a type. One method for adding properties to an object (type) is specialization—deriving a special subclass of a base class object. However, specialization should only be applied when a real-world subclass of the base class actually exists (always). Otherwise, it can create new objects and properties that are difficult to reuse (especially across domains). Rather than specialization, properties may be added to types through type augmentation. This maximizes the reuse of both the augmenting properties as well as the augmented type and avoids the limitations caused by inappropriate use of specialization. Furthermore, it simplifies the process of applying data from multiple domains to NIEM components. In type augmentation, no new entity or subclass is derived. Instead a well-defined container of data properties is simply added to supplement an existing type. The technique is described in detail in the *NIEM User Guide* and the rules are specified in the *NIEM NDR*.

4.3.2.5. Metadata

Metadata, or data about data, defines information that supports the actual content of XML instances. The metadata feature provides a mechanism for attaching structured properties that describe the pedigree or source (when reported, who reported, how reliable, etc.) of instance data to any component of the model (type or object, property, association, role, or augmentation) in any namespace. It allows sets of metadata to be extended with additional properties for local requirements and enables metadata properties to be repeated.

4.4. IEPD Development

The primary purpose for building the NIEM is to facilitate the sharing of information across boundaries. NIEM itself is a data model with a dictionary. In order to begin exchanging information, practitioners need to develop IEPs which are then documented as IEPDs and stored in repositories that can be searched via registries to discover schemas that already exist, use them, and/or modify them to fit the needs of the requiring entity. Information pertaining to the construction, storage, and use of IEPDs is provided in other sections of this document.

4.5. Naming and Design Rules

The modeling concepts described in Section 4.3 are documented in *Naming and Design Rules* (NDR) that governs the definition of NIEM components and provides a basis for NIEM conformance. The *NIEM NDR* is based on published and established standards including:

- Standard specifications from public standards organizations.
- Specifications from government bodies.
- Preexisting data systems.

- De facto standards and common usages by the community.

ISO 11179 provides guidelines for the naming and definition of data elements, as well as information about the metadata captured about data elements. Part 5 of the ISO 11179 Standard establishes a methodology for naming items in data dictionaries. Names in NIEM use object class, property, and representation terms and include multiple parts as follows and as shown in *Figure 8: Sample ISO Naming Convention.*

- *Object Class Term: R*epresents the object to which the property is applicable. In NIEM we interpret that object to be the real world object modeled by the component.
- *Property Term:* Is a plain-language summary of the quality that the property represents.
- *Representation Term: D*escribes the *form* of the data represented. This term is taken from a list of ebXML representation terms, including amount, code, date, time, graphic, identifier, indicator, measure, name, percent, picture, quantity, rate, time, and numeric.

Figure 8: Sample ISO Naming Convention

5. TOOLS AND TRAINING STRATEGY

NIEM provides a reference set of tools freely available with each NIEM release. The tools implement all of the structural and content features of the release—including the NDR. NIEM's well-defined interfaces and output products also support independent third party tools.

NIEM provides training materials such as briefings and process-related documentation as well as other training resources such as a help desk and knowledge base. These materials are posted on NIEM.gov. Training provides the knowledge and know-how the stakeholders need to use the tools and other capabilities provided by NIEM.

The NIEM tools and training opportunities are further described below. More information on the tool strategy can be found in the *NIEM User's Guide* and more information on training can be found in the *Communications and Outreach Plan*.

5.1. IEPD Repository/Library Capability

This capability is being developed in phases. It currently includes the NIEM Schema Subset Generation Tool (SSGT) and the IEPD Tool. The SSGT enables a user to select the elements and types required for a data exchange and save and/or reload the selection in a "want list" file. The user can then generate a conformant schema subset of the full NIEM reference schema set based on the want list. All dependencies are automatically added to ensure the resulting schema subset is valid. The user requirements can be saved and/or reloaded in a "want list" file. The IEPD Tool enables the user to upload/enter the artifacts required for an IEPD (schemas, documentation, and metadata) and assembles it into a package according to the IEPD specification. It can also validate that minimum artifacts and metadata are present. The user creates an account and is granted a work space (My IEPDs). Inside this work space, the user can upload the artifacts to construct any number of IEPDs (complete or partial); share them with other account holders; or search, discover, and download IEPDs that other account holders have marked for sharing.

In the future, these tools will become fully integrated. A user will also have the capability to generate extension and constraint schemas. Moreover, the tool will provide the ability to search and identify IEPDs based on business context. Users will be able to reuse IEPDs, extend them, and then republish them to the repository.

5.2. NIEM XML Data Dictionary Spreadsheet

This is a tangible representation, in Excel, of the entire NIEM data dictionary. It includes all of the element names which are organized hierarchically under core components (person, property, organization, etc.) with hyperlinks to related elements. This spreadsheet also provides information on the type of data being represented (date, integer, string, etc.) and a precise, context-rich definition of each dictionary component.

The XML Data Dictionary Spreadsheet is used to search and identify the specific terminology to input into a component Repository/Library for COIs to discover data for use in constructing schemas for IEPDs. This tool is also used during the data harmonization process, when the NBAC and NTAC are reviewing COI proposal packages for integration into NIEM.

The NIEM XML Data Dictionary Spreadsheet is updated and posted on NIEM.gov with each release of NIEM.

5.3. Information Exchange Modeling Tool

The Justice Information Exchange Model (JIEM)[11] represents a valuable tool for scenario-based planning and for information exchange mapping and modeling. Although initially developed to map and model information exchange throughout the justice domain, JIEM is being revised to apply in other domains and for cross-domain exchanges. Moreover, it is being extended to support the development of IEPDs more directly, as well as to expand functionality in scenario-based planning. The JIEM documents the flow of information between agencies and/or domains by identifying key events and other exchange triggers that initiate the need to share information; identifying the agencies involved in the exchange; documenting the nature of business rules governing the exchange; and capturing detailed information regarding the actual information (i.e., the documents, data sets, and data elements) exchanged. JIEM can be used to map "as-is" exchanges, as well as model "to-be" information exchange requirements and the associated business context.

5.4. NIEM Configuration Control Tool (NCCT)

This tool serves as the current technical issue tracking tool for NIEM in which issues are reviewed and discussed by members of the NTAC and assigned to specific work packages to track how and when they will be resolved. All technical issues and proposed engineering changes are tracked through the entire life cycle and archived through this tool. They are prioritized, marked for criticality, and assigned to specific NIEM releases and or patches. The approved changes are then verified through the Configuration Management (CM) and Quality Assurance (QA) process. This provides clear traceability and accountability for change management of NIEM components and associated releases through the governance processes. The NCCT can be accessed through a link on NIEM.gov. More information on the issue resolution process can be found in Section 6.4.5.

5.5. Component Organization and Registration Environment (CORE)

CORE.gov serves as an internal collaboration and knowledge sharing environment for NIEM governance bodies, such as the NBAC and NTAC, to review and discuss documentation and issues prior to release. Communities exist on CORE.gov for each of the governance bodies that need to share information about NIEM. The communities are permissions-based, only stakeholders with proper permissions are allowed to gain access to a community. Communities can be nested within each other, which allows communities to have subcommunities. Communities are provided work spaces where they can post work in progress (WIP). This allows communities to work on their deliverables within their work spaces without publishing them for public review. Moreover, communities have the option of having discussion threads, which capture a discussion's history. Discussion threads, for example, address topics such as edits to a document or action items assigned to the community.[12] There will be a link on NIEM.gov to access CORE.gov.

5.6. NIEM.gov

The NIEM Web site serves as a primary means by which NIEM can provide the latest documentation and downloads to those interested in the project. It also serves as a starting point for those wishing to contact NIEM staff with questions, support, and information requests. In time, as related projects, tools, and support develop around NIEM, the Web site will become the hub for locating these supplemental resources.

[11] JIEM is a web-based application developed by SEARCH, The National Consortium for Justice Information and Statistics, funded by the Bureau of Justice Assistance, Office of Justice Programs, U.S. Department of Justice. More information regarding this tool can be found at http://www.search.org/programs/info/jiem.asp.
[12] CORE.gov can be accessed at https://collab.core.gov/CommunityBrowser.aspx.

5.7. Component Mapping Template

The component mapping template (CMT) is a Microsoft Excel workbook that COIs currently use to facilitate and document the mapping of their data component requirements for a particular business exchange or family of exchanges to what is currently resident in NIEM. It identifies and characterizes similarities and differences between NIEM and the COIs data component requirements. A component mapping is one artifact required for an IEPD, as defined in the *IEPD Specification*.

5.8. Migration Tools

Migration tools aid the migration between releases of NIEM or those related to helping stakeholders in migrating from Global JXDM. They take various forms:

- Automatically compare a new release to the previous release and provide a general summary of changes and impacts.
- Automatically analyze and report the impact of a new NIEM release on an IEPD Exchange Schema which was built to the previous release in terms of its components.
- Provide style sheet(s) that assist(s) in the transformation of an IEPD Instance Document built on the previous version of NIEM to the current version of NIEM.

NIEM will provide the necessary migration and support tools as a base part of a release to assist the community in acclimating to the new release. Previous versions of NIEM will continue to be supported, and all components are accounted for under their own version and independent namespace. Therefore, IEPDs based on a given version of NIEM that have been implemented for specific information exchanges between end systems will continue to be valid unless the users decide to migrate to the newer version of NIEM.

5.9. Business Component Library

A Business Component Library (BCL) provides the capability that allows domains to save and reuse domain-specific component schemas that they have constructed from sets of NIEM components. For example, the Justice domain may construct my:LawEnforcementAgency from NIEM components for agency identifiers, contact information, and location. This component could be built, identified, stored, and reused in a number of IEPDs built for/by law enforcement. Building BCLs into the NIEM architecture as a middle layer will save IEPD schema construction time. BCL components can be identified, registered, searched, retrieved, and used in new IEPD schemas. This tool is part of the NIEM tool road map and will be developed in the future.

5.10. Help Desk

NIEM will establish a help desk to serve as the entry point for stakeholder questions and issues. It will be able to be accessible by submitting a question via NIEM.gov or via a hotline. Once in place, the help desk will guide users on how to use relevant NIEM tools, data, documentation, and other resources. It will provide orientation to staff and customers on NIEM repositories and Web sites. Finally, it will forward stakeholder questions/issues to the appropriate NIEM staff member for response and resolution.

5.11. Frequently Asked Questions and Knowledge Base

The Knowledge Base is a tool managed by the help desk and serves as a repository of common issues and questions. The most commonly received questions are posted on NIEM.gov as part of the frequently asked questions (FAQ) section of the Web site. This approach provides stakeholders the answers they need quickly.

5.12. Technical Assistance

The Communications and Outreach Program will help address specific questions or implementation needs in the field with respect to NIEM exchange development or participation. Technical assistance will help guide organizations through the IEPD process and recommend strategies for partnering with similar efforts.

5.13. Training and Conferences

NIEM is a continually evolving program, and new agencies and COIs are joining the effort all the time. As new stakeholders come on board, they need to be educated on the necessary information to provide them with the understanding and knowledge of the core capabilities of NIEM and how to engage in NIEM information exchanges. It is the Communication and Outreach Committee's responsibility to identify and coordinate the response to this need, including planning of periodic training workshops and seminars. Some educational materials, such as the *Introduction to NIEM* and *FAQ* are posted on NIEM.gov. Other training materials, such as executive briefings, marketing material, and briefings for conferences/workshops, are tailored depending on the audience.

NIEM staff will participate in relevant industry conferences and workshops, such as the annual Users' Conference. The purpose for these events is to share with stakeholders NIEM status, accomplishments, and objectives, as well as to find new agencies, COIs, and stakeholders to participate in NIEM.

6. NIEM OPERATIONAL PROCESSES

This section identifies the core processes for COIs IEPD development and practitioner-related processes. It also describes the support processes relevant to each of these core process areas. As shown in *Figure 9: NIEM Processes*, these processes are the foundation for putting the NIEM core capabilities to use.

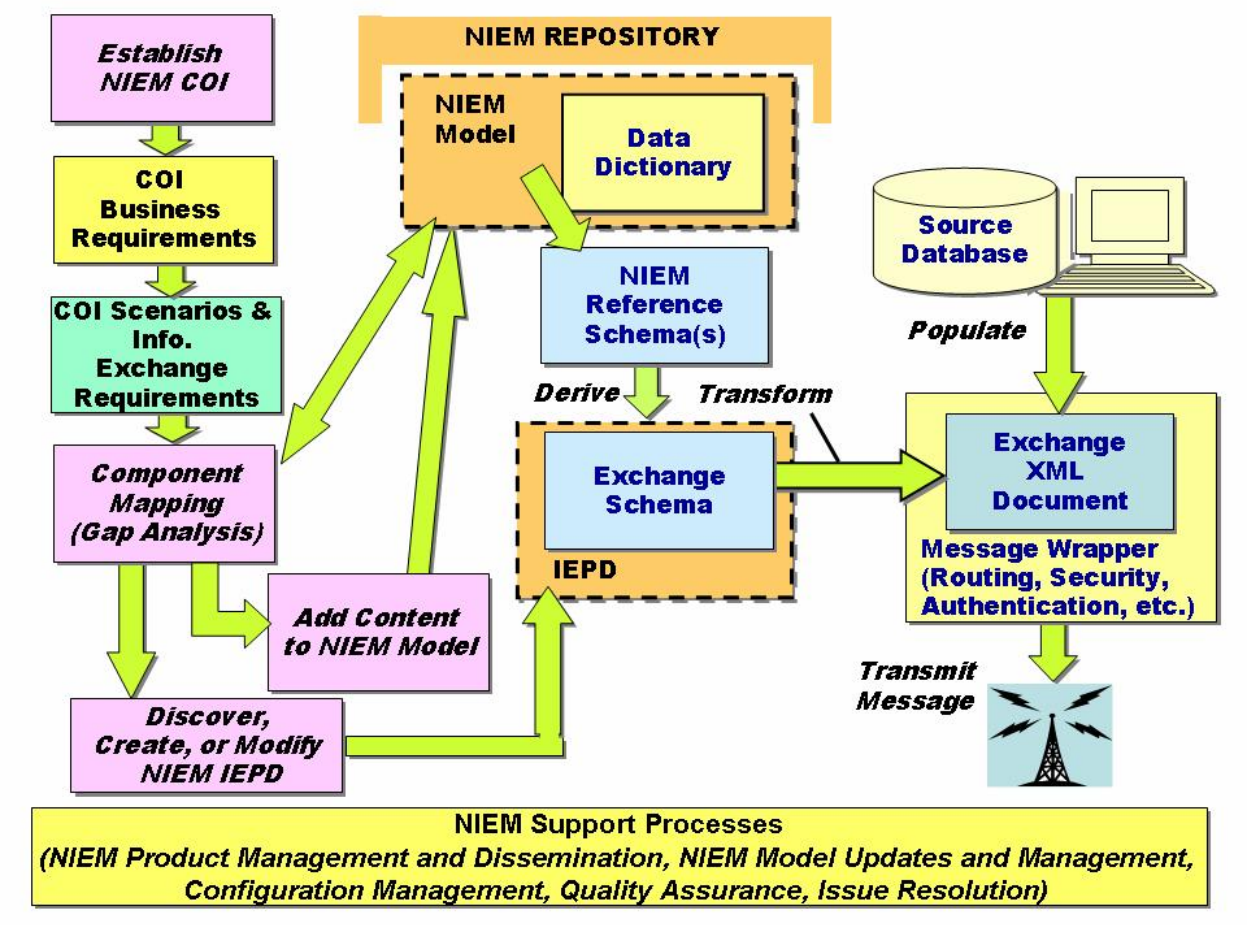


Figure 9: NIEM Processes

6.1. COI Processes

As Section 2.3 describes, COIs are collectives of people (e.g., committees, working groups, or technical subcommittees) who authoritatively represent respective domains such as Justice or Intelligence. This section describes the key processes related to a COI's involvement in NIEM.

6.1.1. Addition of a New COI

Some COIs, such as Justice, Intelligence, and Emergency and Disaster Management, exist today and are actively involved in NIEM. Other COIs, searching for standards to build an information exchange, may initiate a request for information (RFI) from the NIEM PMO. Once the NIEM PMO receives a request by a COI to represent a domain engaged in NIEM, the PMO will perform the necessary due diligence to ensure that the candidate COI does in fact represent an authoritative source for the relevant domain before formulating its recommendation. Due

diligence includes ensuring the COI in question has the requisite policy and technical stakeholders to work within the NIEM governance bodies. Then the PMO reviews the COI's draft components and IEPDs, relating them to what already exists in NIEM to determine if there are any overlaps between the candidate COI and an existing NIEM COI. Finally, the PMO evaluates whether the COI has the processes and tools needed to validate its IEPDs, prior to submitting those it would like to publish through NIEM.

Based on this analysis, the PMO recommends to the NIEM Executive Steering Committee (ESC) to invite the COI to become a new participant in NIEM, invite the COI to join an existing NIEM COI, or to provide further feedback to the COI on other options available and/or actions it must complete to participate in NIEM.

The ESC has the authority to accept or modify the PMO's recommendation. If the ESC decides to modify the PMO's recommendation, then the ESC collaborates with the PMO until final agreement is reached. When the ESC agrees with the PMO's recommendation, then the PMO contacts the COI with its decision. The COI has the option to accept the PMO's decision or to select another alternative. If the COI accepts the PMO's decision, then it will either become a new NIEM COI or join an existing one.

In addition to responding to requests to engage in the NIEM program by existing COIs, the NIEM PMO may, in an effort to further development of information exchange standards across relevant domains, also actively recruit either the participation of an existing COI within a domain or the creation of a COI where none previously existed through communication and outreach activities. For example, one of the near-term objectives for NIEM is to build national exchange standards, or a group of IEPDs supporting specific business areas, such as cargo screening and incident reporting. The PMO would approach a candidate COI, such as *transportation*, to build or participate in building a national exchange standard for cargo screening. The PMO may also decide to present at workshops or conferences for specific business areas not yet represented in NIEM.

6.1.2. Data Insertions

For a new domain, a COI may batch insert data components into its domain, as long as the components are *NIEM NDR* conformant. In this case, the COI should ensure it has coordinated with any other COIs that may have a vested interest in the new domain to prevent possible duplication of data components. Moreover, the COI works with existing COIs to determine if there is any overlap between the new domain and existing domains.

At any time, a COI has the option to recommend promotion of data components from its domain for inclusion in common or universal. The data components to be promoted must conform to the *NIEM NDR*, before they will be considered for promotion.

Additionally, the COI can develop IEPDs for use within its community or use NIEM components to create ad-hoc messages. A COI has the flexibility to submit its IEPD at a later date for review and inclusion in NIEM.

6.1.3. External Standard Adoption

COIs may incorporate any external standard within their domain-specific area, such as those developed by standards development organizations (SDOs) like the International Standards Organization (ISO) and the National Institute of Standards and Technology (NIST).

It is unlikely that standards developed outside of NIEM will conform to the *NIEM NDR*. Therefore, in order to provide an interface between a nonconforming external standard and NIEM, the components needed from the external standard must be encapsulated within NIEM-conforming components and documented. This approach preserves a nonconforming

component's structure and semantics within a NIEM-conformant object that has no semantic value of its own other than to identify its contents and enable other NIEM constructs to use the external component.

If a COI decides to insert part of the external standard into Universal or Common, the standard must conform to the NDR and follow all processes identical to any new content insertion.

6.1.4. Participation in Governance Activities

As a fully vested member in NIEM, representatives from the COI are invited to participate on the NIEM governance bodies including the NBAC, NTAC, and the Stakeholder Panel. The COI's policy and technical representatives participate in activities such as the addition of new domains, collaboration with new or existing COIs, and the harmonization of data components and IEPDs to NIEM for insertion into universal and common. Additionally, some COIs, such as those identified by the FACA, may provide advisory services to the NIEM ESC.

6.1.5. Domain Management

A COI retains the authority to manage its own domain-specific area along with its release and Configuration Management processes. The NIEM development team is responsible for overseeing common, universal, and structures and ensuring all data components adhere to the *NIEM NDR* and other standards. COI releases may be on a different schedule than NIEM releases. The release management processes and policies for how the COI and development team will work together are still under development.

6.2. IEPD Life Cycle

The IEP has a standard shareable life cycle to generate an IEPD (a set of documentation that can be understood between and within specific domains). *Figure 10: IEPD Life Cycle* shows the steps involved in the development of IEPDs.

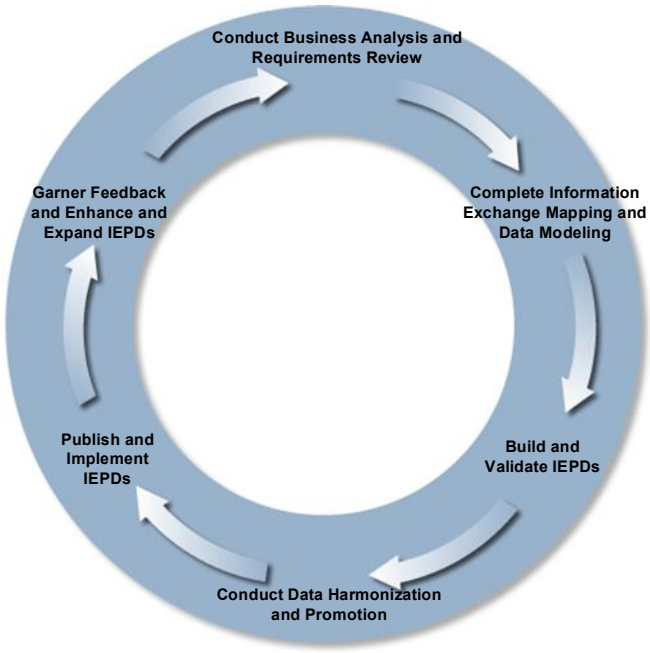


Figure 10: IEPD Life Cycle

The NIEM IEPD life cycle has six steps:

1. Identify scenarios requiring exchange of information and conduct business analysis and requirements review.
2. Complete information exchange mapping and data modeling.
3. Build and validate IEPDs.
4. Ensure data harmonization and promotion.
5. Publish and implement IEPDs.
6. Garner feedback and enhance and expand IEPDs.

6.2.1. Identifying and Documenting Business Requirements

This step defines the business requirements associated with an information exchange for which NIEM is used. It incorporates scenario-based planning, which is the recommended methodology for elaborating the business context of events, incidents, or circumstances in which information exchange takes place. Careful elaboration of a scenario identifies critical operational points at which information must be shared between two or more parties for effective prevention, response, and remediation. Scenarios can be used to depict current (i.e., "as is") information exchange practices among involved parties, thereby identifying gaps, impediments, and other flaws in business processes and data exchange. They may also be used to characterize potential future (i.e., "to be") environments that envision broader and more expansive information sharing, as well as changes in business practice.

As a tool, an organization can use information exchange modeling (IEM) tools[13] to map and model the precise nature of information exchanges. These include capturing information regarding 1) the event that triggers an information exchange (e.g., an arrest of a person, a border entry review, criminal history records check, and automobile stop), 2) the agencies involved in the exchange (e.g., local law enforcement, prosecutor, and U.S. Immigration and Customs Enforcement), 3) the business conditions surrounding the exchange (e.g., whether the subject is an adult or a juvenile, a citizen or a registered alien), and 4) the specific information content of the exchange (e.g., the document, data set, and/or data elements that are actually shared among the agencies). Such tools also enable users to identify pre- and post-exchange events, define the priority and criticality of the exchange, and other key attributes.

6.2.2. Information Exchange Mapping and Modeling

As noted previously, to effectively exchange information across organization and domain boundaries, there must be a common semantic understanding of the data among participating organizations, and the data must be formatted in a semantically consistent manner.

The best method to understand the semantic meaning of data is to document knowledge about data in a structured way. In order to compare one item of data against another and, hence, allow for the exchange of data, the structures of the data must be documented using common documentation standards, such as information exchange packages.

6.2.3. Build and Validate IEPDs

This step ensures there is consistency in the way information is captured, stored, and exchanged and that uniform methodologies exist to support the generation of the IEPDs.

[13] Such as the Justice Information Exchange Model (JIEM). See http://www.search.org/programs/info/jiem.asp.

An IEPD is considered NIEM-conformant if it follows the NIEM architecture requirements for IEPD artifacts and complies with the *NDR*. An IEPD is a complete and precise description of a specific type of information exchange.

- Schemas, including subset, exchange, constraint, and extension schemas.
- Want lists (user requirements).
- Sample instances.
- Sample style sheets.
- Documentation, such as business requirements, memorandums of understanding, domain models, use case models, and business rules.
- Catalog—list of artifacts in the IEPD.
- Metadata to identify and register an IEPD.

A NIEM Repository provides stakeholders with the information and tools to build IEPDs from NIEM components including generating the subset schemas. Users can search and discover existing NIEM components and IEPDs that may be reused in the information exchange they are documenting. It provides a tool to conduct a gap analysis between the data components required in their information exchange and existing NIEM components and an IEPD template that allows a user to create a complete IEPD package, once all of the IEPD artifacts have been created.

Users can draw from components from universal, common, or domain-specific to build their information exchanges. Universal and common components are considered more generic and the domains are able to leverage these components and augment them with a more specific component.

If the user cannot reuse existing data components in the NIEM repository, data components may be modified or defined and built from scratch. All resources available should be used to build an IEPD, including other IEPDs, software tools, methods, data mappings, etc.

To conduct a gap analysis, a COI can use a tool such as the CMT (see Section 5.7) to identify and characterize gaps at the entity (class), element (database attribute), and value (literal) levels between the two models. The *NDR*, as well as other adopted standards and best practices, are used to facilitate this analysis.

Once a COI has completed this analysis and created an IEPD, it may decide to submit its IEPD to NIEM along with a recommendation of what components it would like to insert into universal or common. NIEM may also store IEPDs that are in progress but not yet completed.

6.2.4. Data Harmonization and Promotion

Once the NBAC receives an IEPD along with a request for new content or modification of content, it conducts an initial assessment to determine the following:

- Depending on scope, does the package adequately document the business requirements and proposed solution (complete, accurate, detailed enough, unambiguous, correct format)?
- What is the scope of the submissions impact to NIEM? Which domains are impacted? Are universal and common impacted? How many data components are impacted?
- Have any of the data components in the submission been addressed before?

- Has the submission been coordinated with other groups, tiger teams, or COIs working on the same data components?
- Is the submission conformant with the NDR and IEPD requirements?

Based on the analysis above, the Business and Outreach Director assigns the appropriate committee members (including domain experts and technical personnel) to review the submission. The committee vets the proposal, documenting decisions and justifications and prepares a recommendation to the Business and Outreach Director regarding which, why, how, and when to integrate the proposed changes into NIEM. The Business and Outreach Director evaluates the tiger team's recommendation and decides to accept or modify the proposed solution. This may be an iterative process as the committee provides feedback to the practitioners.

6.2.5. Publish and Implement IEPDs

All NIEM IEPDs and data components are published within a NIEM IEPD Repository/Library. Other stakeholders or COIs can then search and discover published IEPDs for reuse or extend them for a specific instance of the information exchange. A COI may decide to only publish its IEPD through its own domain. There are many options on selecting and implementing IEPD registries and whether they should be federated. In the future, the most efficient and effective one will be selected and implemented.

6.2.6. Garner Feedback and Enhance and Expand IEPDs

This step describes how the COIs work with NIEM to ensure existing IEPDs remain up to date and conformant with NIEM. Moreover, this step includes developing families of IEPDs representing core, priority business areas at the national level. The initial focus areas will include incident reporting, people screening, suspicious activities, cargo screening, emergency and disaster management, and case management. Policies and processes will be developed to support creating, modifying, and implementing these standards. COIs can continue championing and developing their information exchange standards within their own domains or collaborate with other COIs to do the same outside the direct sponsorship of the NIEM PMO.

6.3. Practitioner Life Cycle

NIEM practitioners are the end users in the field using IEPDs to support their daily business activities. These practitioners participate in NIEM by searching and discovering NIEM IEPDs that support their business processes and activities, conducting a gap analysis for whether the information exchange can be used to support their processes, and then determining if they need to extend the IEPD for their own use.

6.3.1. Search, Discovery, and Extension of IEPDs

Practitioners, like other stakeholders and COIs, can use the IEPD Library/Repositories to search on data components and existing IEPDs and to generate schemas. They will evaluate their current and target business requirements and search for the repository artifacts that will best support their business requirements and activities. Practitioners may take what information is available to them in a repository and extend/adapt it to support their specific business requirements and activities.

6.3.2. Gap Analysis

A domain has IEPDs that support multiple business disciplines, and a practitioner may need to use one or more IEPDs to meet its business requirements. The practitioner will conduct a gap analysis of the IEPDs found in a repository and determine to what extent they will help in implementing a specific instance of the information exchange.

6.3.3. Extension of IEPDs

If gaps are found in what is needed, the practitioner may use other resources and tools to complete the development of the IEPD. Practitioners may decide to use an IEPD as is or portions of one or more IEPDs that support the business requirements. The practitioner can extend the artifacts from the NIEM repository and BCL for use in their specific business context.

6.4. NIEM Support Processes

6.4.1. Product Management and Dissemination

Development of NIEM tools and documentation is based on stakeholders' requirements to ensure they have the capabilities they need to have interoperable information exchanges. Stakeholder questions and issues are collected and evaluated by the NIEM governance committees. Other requirements may be identified via the NIEM staff members and governance bodies. Requirements are evaluated and, as appropriate, assigned a specific work package within the *NIEM Program Plan*. The *NIEM Program Plan* tracks the schedule of major tasks related to the NIEM releases.

The Communications and Outreach Committee is responsible for recommending and implementing processes and procedures related to internal communications to ensure the proper checks and balances are in place prior to releasing documentation, training materials, or tools to the public. See the *NIEM Communications and Outreach Plan* for more detail on these processes and procedures. For example, a document such as the *NIEM CONOPS* is developed through an iterative review process. The appropriate stakeholders, in conjunction with full-time NIEM staff, are assigned the responsibility for developing the document. They devise an outline and complete the first draft of the document. As part of this process, all tools and documentation go through the NIEM CM and QA processes, which ensure that requirements are satisfied within the release they were assigned to.

Tools and documentation are delivered to stakeholders via a variety of communication and collaboration tools. The *Communication and Outreach Plan* outlines the guidelines and process used to determine whether a tool or product is for public use. Tools and documentation for public use are posted on NIEM.gov (see Section 4.6). Some tools and documentation are not for public use and would be posted via NCCT or CORE.gov (see Sections 5.4 and 5.5).

6.4.2. NIEM Model Updates and Management

Updates to NIEM are generally one of two types, component (or content) submissions or structural changes. Component submissions may be new or modifications to existing data. Structural changes usually affect the NDR, schemas, tools, etc.

New content submissions or content modifications are requested to be submitted using the CMT (or other similar tool once implemented). All proposed changes are logged into NCCT, whether they are for new or modified content, for tracking purposes. The development team reviews all submissions for completeness and accuracy. If the development team identifies gaps or ambiguities, then the team coordinates with the appropriate PMO staff serving as the liaison to the content contributor. This process will repeat, as needed. Once all gaps and ambiguities are resolved, the development team begins integration of the content into the model.

Structural changes typically arise via the NTAC and are logged into NCCT (see Section 5.4). Like content submissions and modifications, these types of changes are discussed among the appropriate stakeholders. Once a solution is determined, it is passed to the development team to implement.

All changes, modifications and fixes are approved and prioritized by the PMO and associated with a specific NIEM release. For example, some of these items may be of higher priority then others or could take longer to implement versus other simple fixes.

Once NIEM is released into production, the release management process will follow a four phased approach, Alpha, Beta, Release Candidate (RC), and Production. An Alpha release is expected to have major changes and is only under review by the necessary COI, NBAC, NTAC, and PMO stakeholders. The Development team is responsible for making any changes recommended by these teams. If significant changes are identified after approval of the first Alpha release, a second Alpha release would be generated. The number of Alpha releases is dependent upon the number of changes identified. Once all changes are completed and approvals received, the release is moved into the Beta stage.

The Beta stage differs from the Alpha stage because no major fixes/changes are expected. The Beta stage goes through the same process of an iterative update, review, and approval process between the Development team and the stakeholders. If a major change is identified, then the release could be moved back to the Alpha stage and start this process over. Once all changes are completed and approvals received, the Beta release becomes an RC.

The RC is released for final review by the stakeholders. It is possible for minor problems to be identified, and in this case, the RC would go back to the Beta stage. All RCs and related technical documentation are published on NIEM.gov. Each release comes with a set of documentation including:

- The documentation spreadsheet of all types and properties.
- Change log, which provides a summary of all changes since the last release.
- NIEM schemas.

Once all changes are completed and approvals received, the final release package is prepared and NIEM is moved into production.

Other documentation, such as the NIEM User's Guide and NDR, will be updated, as needed, based on changes to the model. These documents will be posted and distributed based on existing communications processes and procedures.

Each release is packaged in a hierarchically organized directory structure and archived to a single compressed file. A release can be thought of as a set of schemas, each of which has its own version number as well as a version number that is assigned to the entire schema package. This process ensures that when the release package is downloaded by a user and uncompressed, the set of schemas are categorized within directories such that imports and namespaces references remain intact and correctly link local file locations.

All previous versions of NIEM will always be available. Version information is built into the NIEM release namespaces so that the same component in one version is not confused with that component in another version. What this means to stakeholders is that they are not required to upgrade their information exchanges IEPDs just because a new version of NIEM is coming out. Information technology (IT) managers will need to make that business decision along with other decisions required to reconcile their program timelines with other efforts external to them. NIEM will not drive or force COIs to release timelines.

6.4.3. Configuration Management

As mentioned in Chapter 2, NIEM is business driven. It is essential to trace satisfaction of original requirements for tools, documents, and processes in NIEM through the CM and QA processes. CM provides the guidelines and administrative process to assure that NIEM work

products and documents are appropriately identified, changes are approved at levels commensurate with their impact, versions and revisions are identified, and configuration baselines for all NIEM artifacts are maintained. Integrity of the NIEM products is insured by institutionalizing, defined, and managed CM process.

6.4.3.1. CM Planning

CM Planning will document the context and environment for the various types of NIEM products and documents, such as:

- NIEM program level artifacts, such as directives, policy, plans, and procedures.
- NIEM products, such as:
  - Standards, specifications, requirements, and documents
  - NIEM model and data dictionary
  - IEPDs
  - NIEM tools and documentation
  - *NIEM User Guide*

It will provide the CM application methods and levels of emphasis to be applied to all NIEM releases. CM will be institutionalized to a large extent by embedding CM guidelines and procedures as part of the business rules basis for the tools used in NIEM development and operation.

Each NIEM working entity will apply CM guidelines to assure a common, consistent approach and methodology with appropriate oversight, management, and responsibilities. Performance measurements to assess the effectiveness of CM functions will be included in QA checklists at key points in the process flow.

6.4.3.2. Configuration Identification and Accounting

NIEM is and will continue to be an evolving set of products, including the NIEM data model, NIEM data dictionary, and IEPDs, as well as an array of associated documentation. As the volume of information, tools, and software expands, it will become increasingly more important to identify NIEM artifacts with a consistent protocol and to maintain the correct associations between the applicable versions of the artifacts in NIEM repositories and Web sites.

NIEM configuration identification and accounting guidelines address:

- Assigning appropriate unique identifiers and the identification source (which is what makes a specific identification unique).
- Providing version and revision identifiers when the configuration changes.
- Capturing metadata reflecting attributes such as the responsible designer, the current change approval authority, and the custodian.
- Assigning release package (baseline) identification to the configurations of artifacts associated with each iteration, while verifying that requirements and design attributes are accurately reflected in the product definition.
- Systematically maintaining baselines, providing the known configuration from which future changes are to be addressed, while retaining prior configuration baselines that may have seen operational implementation.

- Providing secure controlled access to NIEM metadata and artifacts in NIEM reuse libraries/repositories, assuring that the correct versions of artifacts for the intended use are made available to authorized end users.

6.4.3.3. Change Management

Baselines provide a stable basis for continuing evolution of the NIEM configuration. As an integral component of NIEM governance, changes to baselines and the release of work products built from approved components are systematically controlled and monitored using a structured process to evaluate proposed changes. Each NIEM artifact has a designated change control authority.

Change Management guidelines address:

- Criteria for initiating a request for change and assuring that changes add value.
- Documenting and uniquely identifying each request for change.
- Classifying requested changes into an appropriate category to aid in determining the appropriate level of review and approval.
- Identifying the appropriate change approval authority that can approve any change and commit resources for implementation.
- Ensuring that the decision maker(s) is aware of the complete impact of the change by:
  - Assessing and evaluating technical, support, schedule, and cost impacts of a requested change before approval, implementation, or incorporation in the product and product information.
  - Coordinating impacts with the impacted stakeholders.
  - Determining the effectivity (incorporation point, such as version, revision, and time frame) of a change so that the total impacts of the change can be quantified and scheduled.
- Implementing each approved change in accordance with the approved change information and coordinating change implementation with impacted stakeholders before and during change implementation.
- Verifying implementation of a change to ensure consistency among product, the product configuration information, and all product supporting elements.

6.4.4. Quality Assurance

QA addresses the vision, structure, and process within the NIEM organization that will be used to assure NIEM product quality. Quality is largely determined by the quality of the process that is used to develop and maintain it.

6.4.4.1. NIEM Quality Assurance Vision

The vision of NIEM quality is that all NIEM products and documents satisfy agreements; meet or exceed quality standards; comply with approved requirements, processes, and procedures; and are suitable for their intended use. Quality attributes include accuracy, clarity, consistency, coordination, accessibility, and security. Quality is everybody's business. All NIEM functional activities and stakeholders have a share of the responsibility for the quality and effectiveness of NIEM. Oversight and management of the NIEM QA process falls within the purview of the NTAC and operations director. *Figure 11: Quality Assurance Process* illustrates the QA vision and provides an overview of the QA process.

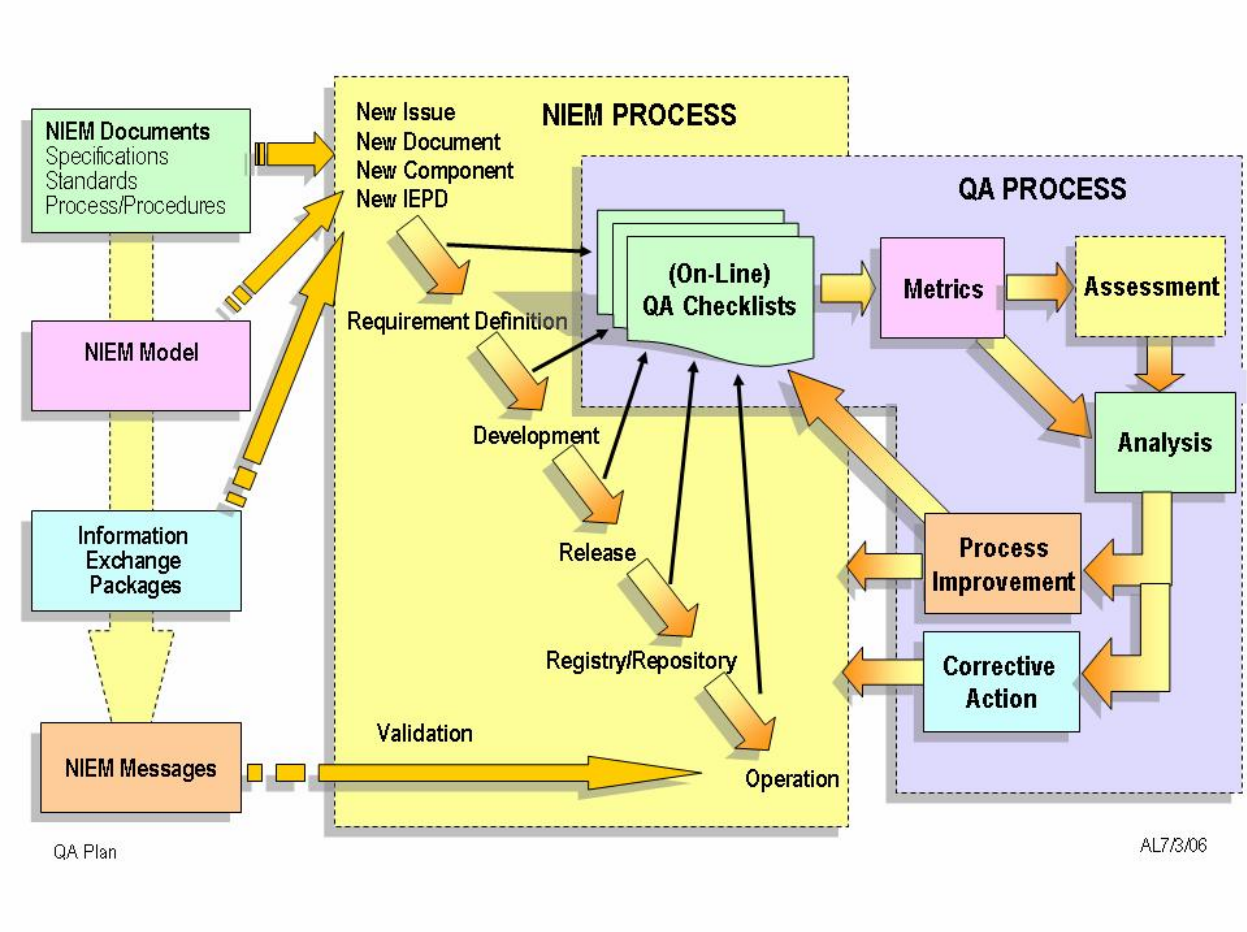


Figure 11: Quality Assurance Process

The objective of the NIEM process and all NIEM artifacts is to provide effective NIEM messages that satisfy the business requirements. In doing so, the effectiveness of the messages is the only criterion that truly validates the process.

As new or modified issues, documents, components, or IEPDs are initiated, they go through a process which generally consists of requirement definition, development, release for use, entry into registries and repositories enabling reuse, and operation. Some of the steps may occur in parallel or may not apply in every case. Entry to each stage of the process will require an appropriate quality check accomplished with a series of relevant QA checklists built into the NIEM process procedures as exit criteria from the prior stage.

Metadata consistent with quality checks collected at each stage of the process includes metrics that are analyzed to identify necessary corrective actions and improvements to both the NIEM development process and the quality process. The metadata, when analyzed and distilled, may also provide records that support periodic quality reviews and audits and internal or third-party assessment of NIEM quality, when these become necessary.

6.4.4.2. NIEM Quality Documentation

NIEM QA documentation will include the *NIEM Quality Assurance Plan* and associated procedures and the quality checklists to be included as part of the *NIEM User Guide*. Additionally, QA documentation will include problem reporting, analysis reports, corrective action reports, and process improvement recommendations.

6.4.5. Issue Resolution

A COI or a member of the NBAC or NTAC may submit an issue to be resolved. The NBAC deals with business issues, such as definitions of specific data components or questions regarding a COI's IEPD submission package, and enters these issues into Core.gov. The NTAC deals with technical or structural issues, such as how to handle external standards or inheritance in the NIEM data model, and enters them into NCCT.

Information regarding an issue must be entered into the issue tracking tool, including:

- Version corresponds to the version of the NIEM release issue it is associated with.
- Issue type describes the topic the issue is related to. Current options include documentation, architecture content, architectural enhancement, governance, and tools.
- Severity describes the impact of an issue. The current options include:
  - Blocker: blocks development and/or testing work.
  - Critical: crashes, loss of data or severe memory leak.
  - Major: major loss of function.
  - Minor: minor loss of function or other problem where easy work-around is present.
  - Trivial: cosmetic problem like misspelled words or misaligned text.
- Enhancement is a request for enhancement.
- Description provides more detail and background on the issue.
- Status indicates the general health of an issue.

When an issue is initially submitted, the issue is assigned a state of "new." Business issues are assigned to the NBAC, while technical issues are assigned to the NTAC. After the NBAC or NTAC review the issue, it assigns a priority that identifies the importance and order in which an issue should be fixed. Five priority levels exist, the highest being 1, the lowest being 5, and the default priority level is 2.

When issues are entered into NCCT or Core.gov, they are sent to the director of the appropriate committee. From here, the NBAC and NTAC follow the same issue resolution process. First, the NBAC or NTAC director reviews the issue and determines whether the issue is actually new or is duplicative to one already in the system. If the issue is indeed new, then it is assigned to the appropriate committee staff for resolution. If the issue is duplicative, then the director, with the assistance of the committee, must determine if the issue needs to be reopened (e.g., the initial resolution is deemed incorrect). If the issue is duplicative and does not need to be reopened, it is then closed and assigned a state of "duplicative." If the issue is duplicative and does need to be reopened, it is assigned a state of "reassigned."

Next, the assigned committee staff is responsible for recommending a possible solution to the issue. The director will review the recommended solution and either approve or disapprove the recommendation. If the director approves the recommendation, then the issue is given a state of "verified." The issue remains in the state of verified until the solution is implemented and the issue can be assigned a state of "closed."

If the director does not approve the recommended solution, then a tiger team may be formed to further evaluate the issue, otherwise the issue is given a state of unresolved. The tiger team then has the responsibility to determine if there are any other alternative solutions.

If the tiger team cannot agree on a solution for the issue (e.g., not enough information is available or a technical issue cannot be reproduced), then the issue is given a state of "unresolved." It is the responsibility of the directors to review unresolved issues on a periodic basis to determine if any new information has been received that could help close the issue. If the tiger team does resolve the issue at any point, then it is given a state of "closed."

Throughout the issue resolution process, as the status of an issue changes, the initiator is notified via e-mail of the status change. Also, if additional information is needed during the evaluation process, further dialogue with the initiator may be needed.

6.4.6. Conflict Escalation

The NIEM governance structure provides the support needed in making decisions related to any conflicts that arise. Conflicts are different from issues because they are related to communication, governance, or program-related topics versus the level of detail tracked through the issue-resolution process. The conflict-escalation process may start at any level. Starting from the beginning of the process, a conflict would be identified by program staff and/or a committee (e.g., NBAC or NTAC). If necessary, it would then be escalated to the appropriate committee director, escalated to the PMO executive director, and finally escalated to the ESC for resolution. At the highest level in the escalation process that a conflict attains, that individual or group is responsible for documenting the resolution and informing all relevant stakeholders.

APPENDIX A: GOVERNANCE ROLES AND RESPONSIBILITIES

This is a summary of each governance entity's roles and responsibilities. The colors in the table refer back to the colors in *Figure 5: NIEM Governance Interactions*.

NIEM Roles	Definition	Responsibilities
EXECUTIVE STEERING COMMITTEE	NIEM Executive Steering Committee represents key public decision makers from local, state, tribal, and federal agencies with significant, vested interest and invested resources in NIEM objectives. The ESC provides strategic direction to the PMO.	Set strategic direction
		Represent and advocate for NIEM at more senior levels of government and among member constituencies
		Assist PMO in securing funding and other resources
		Provide advice, feedback, and support to the NIEM PMO
		Resolve significant issues requiring policy, procedural, or other business decisions, as needed
		Appoint the executive director
EXECUTIVE DIRECTOR	PMO executive director is appointed by the Executive Steering Committee. The executive director provides vision and leadership to the PMO. The PMO directors report to the executive director.	Provide vision and leadership; ensure external communication and reporting
		Plan and manage execution; ensure internal communication and coordination
		Evangelize NIEM with other local, state, tribal, and federal partners
		Secure funding and other resources
		Monitor contracting groups chosen to carry out the work, as required
		Ensure alignment between NIEM and other information sharing councils
		Propose and evangelize target outcomes in consultation with stakeholders

TECHNICAL DIRECTOR	PMO technical director is responsible for the technical aspects of the NIEM Program.	Plan and manage technical execution
		Communicate technical vision and road map
		Ensure aligned operation and agenda of NTAC
		Manage tool identification, development, and implementation in response to user requirements
BUSINESS and OUTREACH DIRECTOR	PMO business and outreach director is responsible for developing working relationships between local, state, tribal, and federal agencies. This position will be vital in implementing projects that require considerable funding from the information sharing community.	Coordinate local, state, tribal, and federal collaboration
		Manage documentation development, outreach, and training
		Steward IEPD Repository, business domain structure, and data domain
		Ensure smooth operation of NBAC and communications and outreach and coordinate execution of NIEM to plan with partners
		Ensure business-driven approach
OPERATIONS DIRECTOR	PMO operations director is responsible for delegating and assigning resources to resolve NIEM Program issues.	Ensure that NIEM governing components have the required resources to meet objectives
		Ensure that the NIEM day-to-day operations and implementation are supported
		Manage and task program staff
		Review NIEM documents and process submissions
		Vet proposed NIEM documents and processes through stakeholders
PROGRAM STAFF	PMO program staff is the operational body responsible for the daily implementation of NIEM processes. The PMO staff positions are full time.	Capture and frame requirements and issues
		Ensure quality of releases and associated documentation
		Coordinate, track, and implement priorities
		Provide staff support to NBAC and NTAC
		Manage Core.gov NIEM assets

		Ensure data harmonization and QC
		Ensure functional standard evangelization
COMMUNICATIONS AND OUTREACH	Communications and outreach (C&O) addresses the specific tasking of the business director. It provides a network for practitioners and advisory and stakeholder members with a shared interest and expertise. The C&O positions are full time.	Provide training, technical assistance, and outreach in support of NIEM
		Develop marketing material
		Manage NIEM.gov Web site
		Identify and manage collaboration tools
		Suggest processes and procedures for internal and external communications
HELP DESK	Help desk assists potential NIEM participants in developing and designing IEPDs for insertion into the NIEM. The help desk works directly with communications and outreach to expand the NIEM Initiative under the direction of the operations director. The staff will hold full-time positions.	Guide users on how to use relevant evaluation databases, research tools, data, and statistics
		Provide orientation to staff and clients on NIEM repositories and Web sites
		Direct clients to evaluation experts and organizations in their specific areas of interest or others working on similar evaluations
		Help to resolve problems related to using the NIEM model and processes
DEVELOPMENT	Development implements appropriate technological solutions to improve the effectiveness and efficiency of the NIEM under the direction of the PMO.	Establish effective processes and structures to facilitate information sharing among and between government entities and the private sector
		Develop NIEM technical standards
		Maintain and update versions of the NIEM
		Release management
NIEM TECHNICAL ARCHITECTURE COMMITTEE	NIEM technical architecture committee is lead by a committee of information sharing and technical architecture subject-matter experts to advise the development team.	Ensure core structure and architecture including naming and design rules
		Coordinate architecture with domain partners to ensure continued interoperability
		Ensure coordination with parallel information exchange efforts
		Domain architecture, IEPD template and registry, concept of operations, governance

		Provide data harmonization methodologies, policies, practices, activities, and findings in response to inquiries received
		Reconcile data security, privacy, and sensitivity issues through technical solutions that enable data sharing
NIEM BUSINESS ARCHITECTURE COMMITTEE	The NIEM Business Architecture Committee is lead by a committee of information sharing and business architecture subject-matter experts to advise the practitioners and COIs.	Make recommendation for insertion of objects into common core and promotion into universal core
		Represent business interests of related domains
		Develop and promote best practices
		Identify data security, privacy, and sensitivity issues
POLICY ADVISORY PANEL	The NIEM Policy Advisory Panel makes recommendations to the PMO on political, organizational, legal, technical, cultural, and personnel issues.	Interact with policymakers, government leaders, and planning committees
		Recommend budget and marketing processes
		Identify legal, policy, administrative, funding, and technical requirements and other obstacles to achieve NIEM vision and goals
ADVISORY COMMITEE	The NIEM Advisory Committee exists to serve as a vehicle for the diverse communities to provide input into the NIEM Program.	Provide recommendations to the NIEM Executive Steering Committee
		Provide advice, feedback, and support to the NIEM PMO and Executive Steering Committee
		Participate in periodic, prescheduled meetings.
STAKEHOLDER PANEL	The NIEM Stakeholder Panel consists of members that have a stake in or may be impacted by a given approach to the NIEM. The Panel advises the executive director on matters that will impact their operations.	Contribute to the development of goals for NIEM
		Share information about NIEM with others
		Provide access to the resources of NIEM for their client groups
		Assist in evaluating the work of NIEM by collecting evaluative information
		Provide feedback to the PMO regarding the work of the organizations

		Maintain current information about their own agency or organization in all NIEM publications and products
PRACTITIONERS	NIEM practitioners include NIEM users, developers, and enthusiasts who make recommendations to the NBAC committee on issues related to the implementation and promotion of NIEM.	Assist in developing new strategies, search techniques, and organizational structures for the dissemination of information
		Assist in evaluating the work of NIEM by coordinating the collection of evaluative information from users
		Develop and participate in a study of the information-use patterns in all segments of the information sharing communities

APPENDIX B: TERMS AND DEFINITIONS

The following list is a subset of key terms and their definitions, which are necessary to understand the core concepts discussed in this document. The complete NIEM Terms and Definitions can be found on www.NIEM.gov.

- *Association:* A NIEM construct that represents a relationship among two or more objects. A type, named for the kind of relationship it represents, that links multiple objects under specific contexts and may contain properties that are characteristics of the relationship. This allows the preservation of the object-oriented design principles of the data model, while allowing more granular specificity of meaning when two or more data objects are related.
- *Augmentation (or Type Augmentation):* A NIEM technique that enables the reuse of type extensions that occur within particular domains for use elsewhere. Type augmentation avoids the need to create new specialized entities and duplicate type extensions that could not have been reused. Instead, the technique simply supplements an existing type with a reusable set of properties required for a given context.
- *Business Context:* A common frame of reference across business areas or domains allowing organizations to share information with specific goals or scenarios in mind.
- *Business Scenarios:* Real-world scenarios that are used to describe or justify a use case for a certain business model.
- *Code Table (or Code List):* A set of related data values and their definitions (or literals) that are valid for a given NIEM property that is represented as an enumerated type (i.e., coded). In NIEM, a code table is in its own target namespaces and can be internal or external. More formally, a code table or list is an XML schema type definition that restricts xsd:string or xsd:token to an xsd:enumeration of a fixed, finite set of values; or any type derived from such a type. An XML schema enumerated element is defined by its Code Table (i.e. its type definition).
- *Common Component:* A reusable component that meets technical standards, complies with NIEM requirements, is common across one or more (but not all) participating domains, and is contained in the NIEM Common namespace.
- *Community of Interest (COI):* An authoritative source responsible for developing, harmonizing, and managing the data components (vocabularies) found in interdomain exchanges.
- *Component (the data sense):* An object meant to interact with other objects, encapsulating certain functionality. For NIEM, component is a relatively generic term normally used to reference data constructs contained in the NIEM data model and reused to build IEPDs. A component may be a simple or complex type, a property, constructs built for a particular BCL, or any other complex combination of these assembled into a structure. An IEPD may be considered a large complex component. Components are built from components.

- *Configuration Management:* The guidelines and administrative process to assure that NIEM work products and documents are appropriately identified, changes are approved at levels commensurate with their impact, versions and revisions are identified, and configuration baselines for all NIEM artifacts are maintained.
- *Constraint Schema:* An XML schema that further restricts or constrains instance content specified in the corresponding subset schema.
- *Core:* The Core refers to the NIEM data model, composed of the universal and common namespaces, containing all components that are determined to be relevant and semantically agreed upon by some or all participating domains. NIEM Core could be said to contain all reusable components that are not domain-specific and are governed by NIEM processes and policies regarding promotion and maintenance of those components.
- *Data:* Facts represented in a readable language (such as numbers, characters, images, or other methods of recording) on a durable medium. Data on its own carries no meaning. Empirical data are facts originating in or based on observations or experiences. A database is a store of data concerning a particular domain. Data in a database may be less structured or have weaker semantics (built-in meaning) than knowledge in a knowledge base. Compare data with *Information*.
- *Data Dictionary*: A set of metadata that contains definitions and representations of data elements.
- *Data Element:* A basic unit of data having definition, identification, representation, and values; the lowest level of physical representation of data.
- *Data Exchange:* Fixed, reoccurring transactions between parties, such as the regular exchange of environment testing data among federal, state, local, and tribal entities.
- *Data Harmonization:* The process of comparing two or more data component definitions and identifying commonality among them that warrant their being combined, or harmonized, into a single data component.
- *Data Model*: A graphical and/or lexical representation of data, specifying their properties, structure, and interrelationships.
- *Data Promotion:* The identification of data components that are semantically agreed upon between more than one domain, or with all domains, and are reclassified in a higher-level namespace to reflect that fact (typically to common or universal).
- *Data Standard:* The structure for representing data in machine-readable format, often used to facilitate information exchange through common understanding and recognition of the data elements used.
- *Discovery:* The act of locating a machine-processable description of a Web service-related resource that may have been previously unknown and that meets certain functional criteria. It involves matching a set of functional and other criteria with a set of resource descriptions. For NIEM, discovery normally refers to the search for IEPDs and data components within a repository that can be reused in IEPD development.

- *Document Schema:* A schema, within an IEPD, with the purpose of defining the actual content model of an information exchange. The document schema works in conjunction with the subset, extension, and constraint schemas to form a complete package that represents the exchange. This is a more specific term for *Exchange Schema*.
- *Domain:* A namespace of data components associated with a group of one or more COIs.
- *Domain-Specific Components:* A component that meets technical standards, complies with NIEM requirements, and is specific to only one domain.
- *Element:* The fundamental building block of an XML document. XML elements can contain other elements and/or data. XML elements are composed of a start tag, content, and end tag.
- *Enterprise:* A business association consisting of a recognized set of interacting business functions, able to operate as an independent entity.
- *Exchange Mapping:* The process of comparing desired exchange content to the exchange specifications in order to ensure semantic compatibility prior to information exchange.
- *Exchange Model:* A reference to the National Information Exchange Model as a provider of exchange modeling standards and best practices.
- *Extensible Markup Language:* XML is a structured language for describing information being sent electronically by one entity to another. XML schema defines the rules and constraints for the characteristics of the data, such as structure, relationships, allowable values, and data types.
- *Exchange Schema:* The XML schema that describes the document or set of data to be exchanged. This is a more general term for a Document Schema.
- *Exchange Specification:* Any details describing the exchange, including schemas, business rules, and more. This term often describes the contents of an Information Exchange Package Documentation (IEPD) (or Description).
- *Extension Schema:* An XML schema that defines data elements that are to be used in an exchange but do not exist in the NIEM model, which therefore must be extended.
- *External Standard:* A standard with a governing body outside the scope of NIEM whose products must be used in conjunction with NIEM in exchanges.
- *Framework:* In software development, a framework is a defined support structure in which another software project can be organized and developed. A framework may include support programs, code libraries, a scripting language, or other software to help develop and glue together the different components of a software project.
- *Gap Analysis:* An analysis performed to identify overlaps and gaps between one or more information sets, systems, or exchange methods. This is often one of the first steps taken by two organizations looking to engage in information exchange.
- *Governance:* The system and manner of providing authority and control.
- *Information:* Contextual meaning associated with, or derived from, data.

- *Information Exchange:* The transfer of information from one organization to another, specifically in concert with NIEM IEPD exchange processes and recommended procedures.
- *Information Exchange Package:* An actual exchange instance; usually an XML instance; the real data and metadata transmitted on the wire; may also refer to the additional layering for transport, delivery, security, etc.; the data exchanged between a sender and a receiver.
- *Information Exchange Package Documentation:* A collection of artifacts that define and describe the structure and content of an IEP.
- *Information Sharing:* The broad concept of sharing information between agencies or organizations who do not inherently have access to such information. The need for robust nationwide information sharing is the guiding principle of the NIEM program.
- *Interoperability:* The ultimate goal of any information sharing exercise that refers to the seamless interconnection between disparate systems for the purposes of sharing information relevant to either party. Interoperability is both a prerequisite and a result of efficient information sharing.
- *Message:* The basic unit of communication between a requester and a provider. It should encompass an XML Message Instance defined by an IEPD relevant to the message exchange.
- *Metadata:* Structured data about data. Metadata includes data associated with either an information system or an information object for purposes of description, administration, legal requirements, technical functionality, use and usage, and preservation.
- *Namespace:* A collection of names, used in XML documents as element types[14] and attribute names[15], that is identified by a prefix linked to an URI reference. Using XML namespaces alleviates naming conflicts in XML that arise when XML elements and attributes from different sources use identical names.
- *Naming and Design Rules*: The NDR includes rules and principles that are intended to establish and, more importantly, enforce a degree of standardization at the national level.
- *Quality Assurance*: A process by which the quality of design and performance of a system or data is tested and verified prior to implementation.
- *Registry*: Authoritative, centrally controlled pointer to information in repositories that facilitates discovery and reuse. A NIEM registry of IEPDs would act as a store or pointer to all known IEPDs in existence or currently under development to allow implementers to take advantage of parallel efforts.
- *Repository:* An information system used to store and access information, schemas, style sheets, controlled vocabularies, dictionaries, and other work products. It would normally be discovered via a registry.

[14] http://www.w3.org/TR/REC-xml#dt-stag.

[15] http://www.w3.org/TR/REC-xml#dt-attrname.

- *Role:* An independently valid context-specific specialization that enhances the desired contextual meaning of a component in a data exchange. For example, a person component could take on the role of a law enforcement official, a witness, or a plaintiff. By utilizing a role methodology, the object-oriented nature of the model can be preserved, while allowing explicit customization that does not depend on object inheritance.
- *Scenario-Based Planning:* A process of planning and identifying data exchanges by analyzing a business process and describing information exchanges using business use-case scenarios to justify the need for those exchanges.
- *Stakeholder:* A person or organization that has a legitimate interest in a project or entity; anyone with an interest (or "stake") in what the entity does.
- *Subset Schema:* A subset of the primary NIEM reference schema, whose components are taken entirely from the parent schema while excluding those components that are unnecessary for a given exchange.
- *Type:* A description of a class of objects that share the same operations, abstract attributes and relationships, and semantics. The operations aspect of a type is a programming concept related to methods and is, therefore, not applicable in NIEM, which uses only the data aspects.
- *Type Extension:* A description of a class of objects that share the same operations, abstract attributes and relationships, and semantics. The operations aspect of type extension is a programming concept related to methods and is, therefore, not applicable in NIEM, which uses only the data aspects.
- *Universal Component:* A component of the NIEM model that is defined in universally acceptable terms across all NIEM participating domains and is reusable.
- *Use Case:* A business process example used as a basis for exchange modeling, whose description includes an information flow. See also Scenario Based Planning.
- *Want List:* A portable construct used in the SSGT to save and reuse schema subsets of the overall NIEM data model. A want list can be saved or loaded directly from the SSGT tool. A want list is an XML instance that specifies the NIEM components required (and therefore selected) by the user for the subset schema he/she is building. It does not include NIEM components the user selected set depends on.
- *XML Instance:* An XML document that contains actual data and whose format and inclusion is specified and validated by an associated XML schema.
- *XML Schema:* Defines the vocabulary (elements and attributes), the content model (structure, element nesting, and text content), and data types (value constraints) of a class of XML documents. NOTE: When written with a capital S, the term refers specifically to the XML Schema Definition (XSD or WXS) language developed by the W3C. However, when written with a lowercase s, the meaning is more generic, referring to any of several schema languages for use with XML, such as DTDs, RELAX NG, Schematron, etc. In both cases, an

XML schema is used to validate XML instances, to verify that the instances conform to the model that the schema describes.

APPENDIX C: ACRONYMS

- *BCL:* Business Component Library
- *BJA:* Bureau of Justice Affairs
- *CM:* Configuration Management
- *CMT:* Component Mapping Template
- *COI:* Community of Interest
- *CONOPS:* Concept of Operations
- *DHS:* U.S. Department of Homeland Security
- *DOJ:* U.S. Department of Justice
- *EIC:* Emergency Information Consortium
- *ESC:* Executive Steering Committee
- *FACA:* Federal Advisory Committee Act
- *FAQs:* Frequently Asked Questions
- *Global:* Global Justice Information Sharing Advisory Committee
- *Global JXDM:* Global Justice XML Data Model
- *HSPD:* Homeland Security Presidential Directive
- *IEM:* Information Exchange Modeling
- *IEP:* Information Exchange Package
- *IEPD:* Information Exchange Package Documentation
- *IJIS:* Integrated Justice Information Sharing
- *IRTPA:* Intelligence Reform and Terrorism Prevention
- *ISO:* International Standards Organization
- *JIEM:* Justice Information Exchange Model
- *MOU:* Memorandum of Understanding
- *NBAC:* NIEM Business Architecture Committee
- *NDR:* Naming and Design Rules
- *NIST:* National Institute of Science and Technology
- *NTAC:* NIEM Technical Architecture Committee
- *OASIS:* Organization for the Advancement of Structure Information Standards
- *OOP:* Object-Oriented Programming
- *PMO:* Program Management Office
- *PMP:* Performance Management Plan
- *QA:* Quality Assurance
- *RC:* Release Candidate

- *RFI:* Request for Information
- *ROI:* Return on Investment
- *SDO:* Standards Development Organization
- *SSGT:* Schema Subset Generation Tool
- *US:* United States
- *VIN:* Vehicle Identification Number
- *W3C:* World Wide Web Consortium
- *WIP:* Work in Progress
- *XML:* Extensible Markup Language